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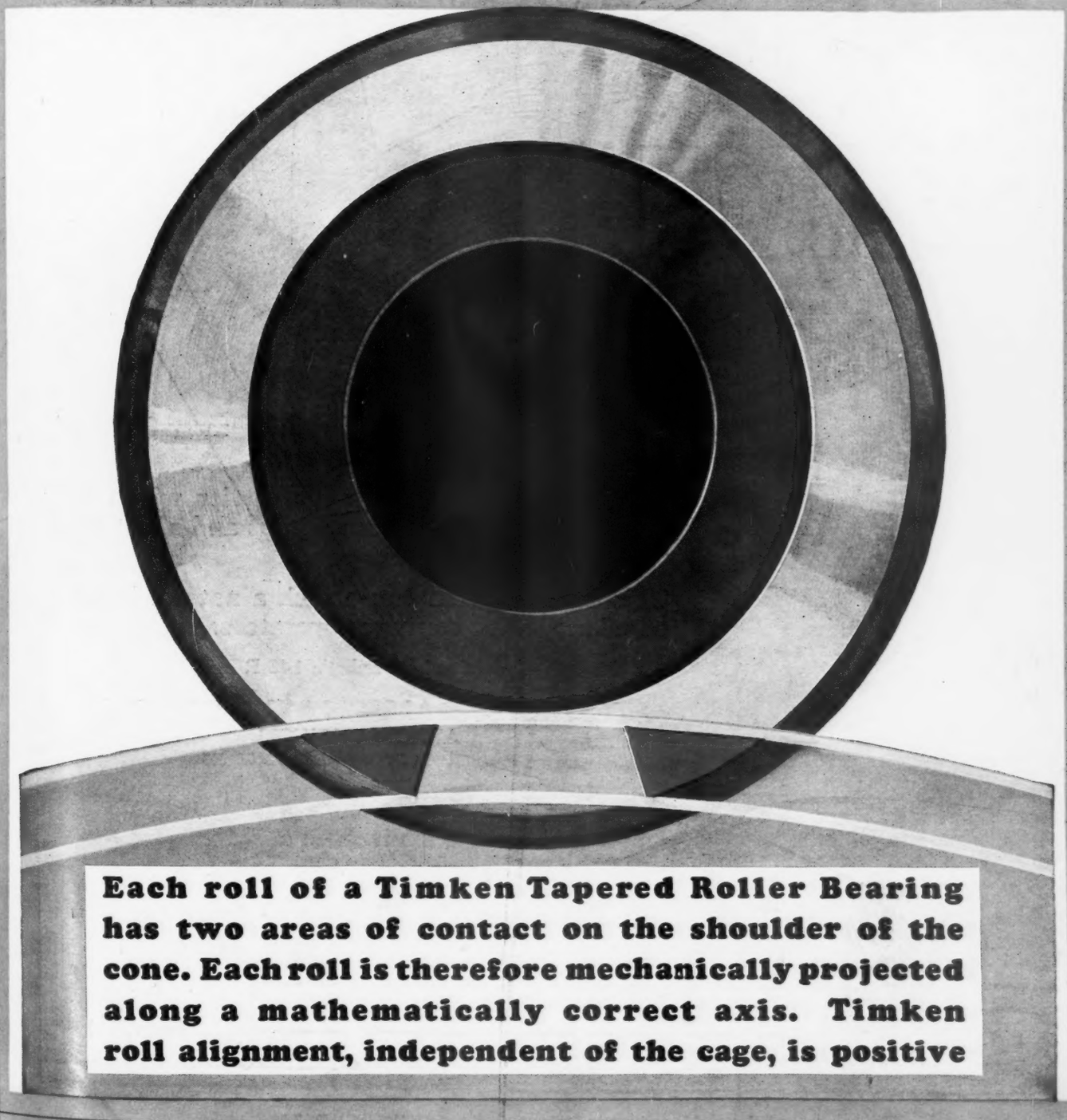
Chicago, February 6, 1926 (*Issued Every Other Week*) Volume XXIX, No. 3



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Volume XXIX | Chicago, February 6, 1926 | Number 3

Dredging and Crushing Oyster Shells

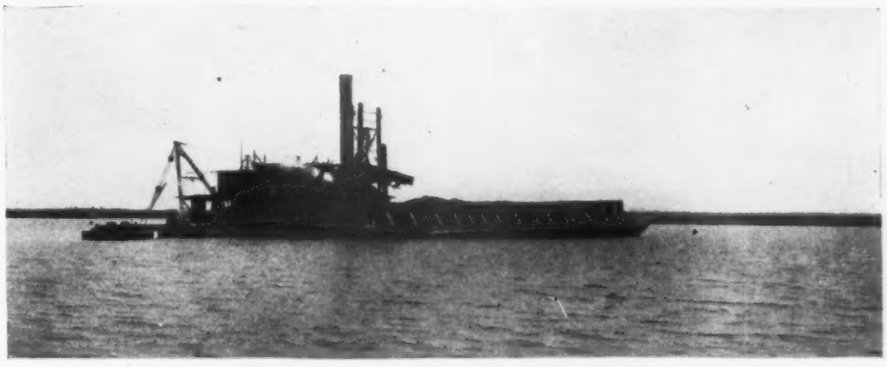
Gulf Crushing Company Operation, Morgan City, Louisiana

RECENT years have brought about the development of an industry in south Louisiana, centered at Morgan City, which annually ships 100,000 tons of crushed oyster shells to points throughout the United States, Canada and abroad.

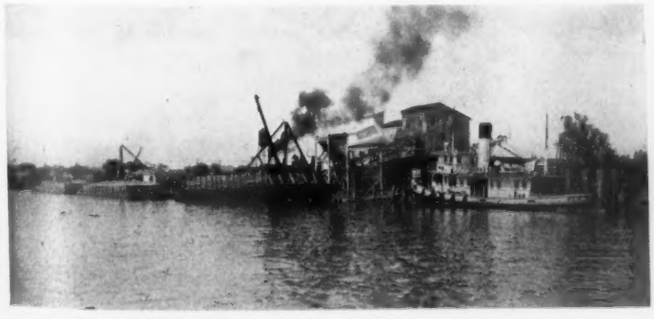
About four years ago, oyster shell was procurable only in limited quantities from Atlantic and gulf coast canneries. Their output, crushed to a size suitable for poultry consumption, was distributed within a short haul of the producing points. Cannery shells are still being used and crushed for poultry, but their output is said to be diminishing, due to a steady decrease in the oyster crop along the Atlantic seaboard. Yet, today the volume of oyster shells now being crushed is almost double the former output, and as a result of almost world-wide advertising, the total tonnage promises to grow into still greater proportions.

Morgan City today produces nearly 50% of 220,000 tons, the annual output of the United States. This new industry resulted from the commercializing of the reefs of oyster shell lying off the coast of Louisiana and largely at and west of the mouth of the Atchafalaya river. Formerly these reefs were considered merely a nuisance and a menace to navigation, but researches made by the Louisiana State Conservation Commission brought to light that these were valuable as the basis of industry. Analyses proved that the shell were almost pure calcium carbonate.

The development of these reefs was first begun to produce crushed oyster shell in convenient sizes for poultry. It was later learned that this form of lime is equally valuable as a bone builder for all kinds of animals; that it is one of the most valuable forms of soil sweetener, and that as a road building material the shell, as it comes from the reefs, provides an economical highway. Thousands of tons are being used as rail-



Dredging oyster shells at the mouth of the Atchafalaya river near New Orleans



Crushing plant at Morgan City, La.

Stock piles of finished product

way ballast. Furthermore, it was found that the shell could provide lime for certain chemical industries and the manufacture of portland cement.

For thousands of years oyster shell reefs have been forming off the coast of Louisiana. The coastal waters of Louisiana produce superior oysters, but there is a territory adjacent to the mouth of the Atchafalaya river, subject to changes which invariably destroy oysters, which have tried to establish a foothold there. During seasons of normal rainfall or seasons lacking flood conditions, the waters of the lower Atchafalaya river, the Atchafalaya bay and the east and west Cote Blanche bays become of that saline character which is propitious to the growth of the oyster. It is under such conditions that millions of seed oysters, moved by tides and currents, enter these waters and begin their growth. They thrive in some instances for more than a year, but sooner or later the flood volume of fresh water, which is drained from the Mississippi, through the Atchafalaya, drives out the salt content from these bays and destroys every vestige of oyster life. There remains only an additional layer of the shell.

For untold years there has been this alternation of fresh and salt water and every change has left its quota of dead oysters until today there is an accumulation estimated to contain more than a hundred million tons.

A sea going dredge with a cutter head for breaking up the reefs was especially designed to meet the conditions found in dredging reef shell. The hull of the dredge is made of creosoted timbers. Ample living quarters are provided and it is equipped with a 225-hp. semi-Diesel engine, directly connected to the intake pump on one end by use of cut-off couplings, and at the other end to generators used to generate current for a hoisting engine and various pumps. The dredge has a capacity for about 200 cu. yd. per hour.

A revolving washing screen is installed on the dredge, which thoroughly cleanses the shell before it is loaded on to the large steel barges. Two steel hull tugs, one of which is used as a dredge tender and for occasional tows, and the other for transporting filled and empty barges, are employed.

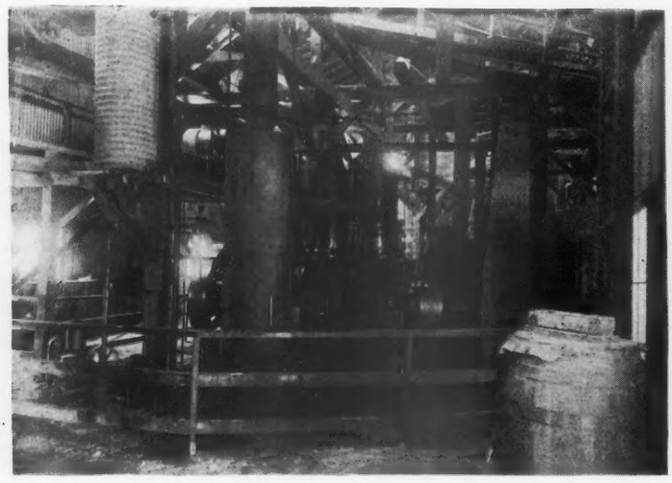
Two unloading rigs have been provided at the plant wharves. One of these delivers the shell from the dredge to a hopper, thence to a belt conveyor, where it is started on its movement through the factory. The other lifts the material directly from the barge to railway cars or on to other barges for delivery by water.

The shell which goes to the factory is dumped from the belt conveyor into a large revolving screen. Under a high pressure of water the shell receives its second washing and screening. After passing through this the shell is fed to a hammer mill, where it is broken and then returned by bucket elevators for further screening and washing. When the shell has been reduced to proper size and thoroughly cleansed, it is conveyed by belt to the stock pile. The fines or sizes too small for chicken feed are run through sluices to settling basins and recovered for use as lime for fertilizer purposes.

The system of wet grinding used here was designed by J. H. Scott, and installed by the Allis-Chalmers Co., with a view to eliminating the dust nuisance which characterizes most operations of this character. From the stock pile the crushed and washed poultry feed is reclaimed and run through a large revolving dryer fired by oil. After drying, the product is again passed over screens which remove any dust and separate the crushed particles into sizes suitable for bone builder, chick and medium sized grades.

The finished product is collected into overhead bins from which it passes to automatic weighing machines and is delivered by chutes into new 12-oz. bags, sewed and delivered by conveyor into a railway car.

Separate loading facilities and tracks are used for the manufactured product and for the raw shell, facilitating as far as possible the daily movement of approximately 10 carloads of crushed shell for poultry and an even larger amount of the raw material for ballast and road building purposes.



Interior of oyster-shell plant at Morgan City

Dryer in pulverizing plant at Morgan City

Arkansas Lime Plant Increases Capacity

ANNOUNCEMENT has been made of the purchase of the interests in the plant and properties at St. Joe, Ark. of the Moss De Voy Lime and Stone Co. by the St. Joe Lime and Stone Co. of Little Rock, Ark. By this deal the Moss De Voy Co. retires from their lime and crushed stone operations in St. Joe. The new owners have reorgnized the company under the name of the St. Joe Lime and Stone Co. and are planning extensive improvements.

Tracks for the dump cars from the limestone ledge to the kiln and crusher are being straightened and a new system installed to accommodate the increased equipment, which is shortly to be installed. This includes another kiln, a modern hydrating unit and additional machinery for producing agricultural lime.

There will also be additional buildings constructed for housing the barrel plant and for additional storage capacity, and the railroad siding, a spur from the M. and N. A., will also be extended to provide for the increased capacity.

The present daily output of about 50 tons of crushed stone and 50 tons of agricultural limestone in addition to the 150 bbl. of lime is expected to be doubled when the new changes have been made.

The company's officers are John O. Willson, president and general manager; Gilbert Stacy, vice-president, and J. W. Truschman, secretary. Offices are maintained at 120 East Third St., Little Rock, Ark.

A New Sand and Gravel Plant in the Los Angeles District

Competition for Most Efficiently Designed and Operated Plant Makes Harris and Hull Plant Interesting

By P. E. Van Saun, M. E.

Pacific Coast Representative, Kennedy-Van Saun Manufacturing and Engineering Co., Los Angeles, Calif.

AMONG the foremost producers and distributors of sand, gravel and crushed stone in the Los Angeles district is Harris and Hull, Inc., of Los Angeles, Calif., who own two plants. Their major operation, plant No. 1, is on the Big Tejunga wash near Roscoe. Its location near the mouth of the canyon was well chosen since the proportion of rock from the large boulders and coarse gravel as compared to the less valuable sand is greater than in the case of plants located on deposits further from the source of the material. This is explained by the classifying action of the flood water which sweeping down the canyons transported a gradually lesser proportion of coarse material to be deposited on the widening and more nearly level portions of the streams toward their valley outlets.

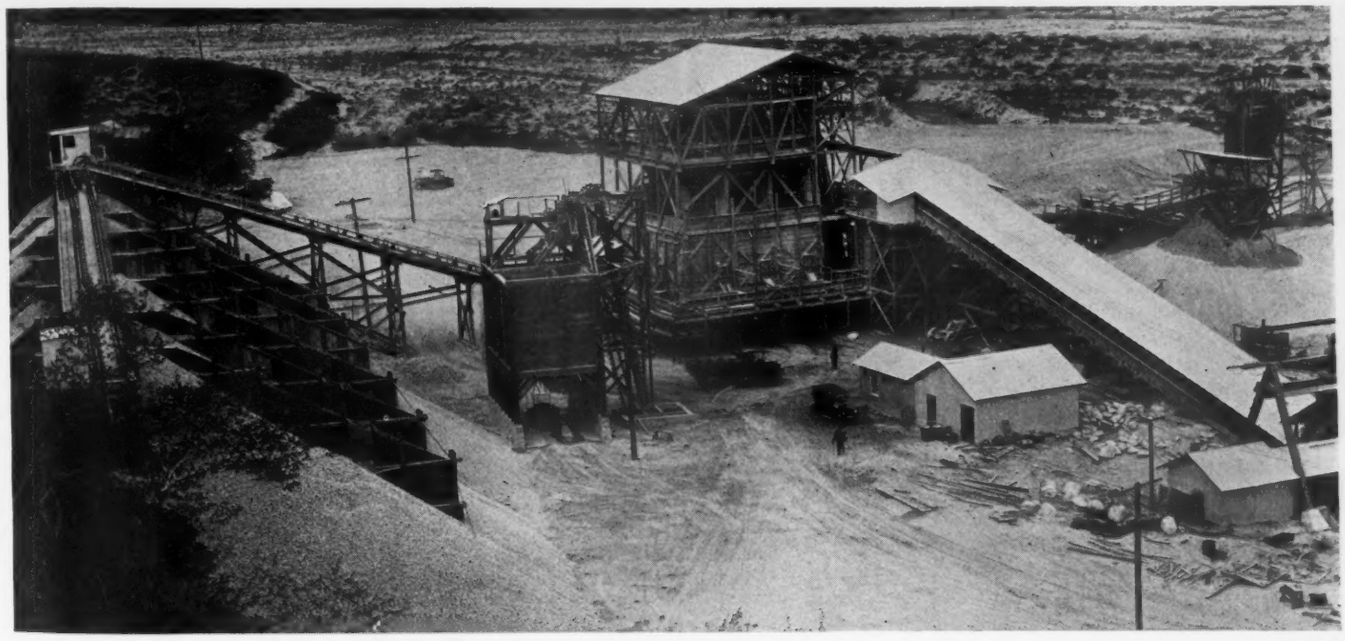
About three years ago Harris and Hull acquired this property which had been equipped with a small crushing and screening plant. This was soon found unprofitable to operate, by reason of its inefficiency and limited output.

It was, therefore, enlarged and modernized and more recently an adequate ground storage for the segregated materials has been added, so that this plant now is highly efficient in production and in meeting the exacting trade requirements for large quantities of any product.

The material is excavated by a 30-B Bucyrus steam shovel with 1-yd. dipper, which loads it on Western dump cars carrying about 6½ cu. yd. each. These are hauled in two trains of three each, by 8-ton Plymouth gasoline geared locomotives of 36-in. track gage, to the plant, an average distance of about 2000 ft. from the present place of excavation.

These cars are dumped over a manganese steel grizzly, having 5-in. spaces between the bars.

The oversize boulders drop into a Kennedy-Van Saun hinged steel frame jaw crusher having 42x30-in. receiving opening. This machine is set to crush to 5-in. and finer. The grizzly "through" product drops into a 10-ton capacity hopper which is provided with an 18-in. reciprocating plate feeder for uniform delivery to its receiving belt conveyor. Two 24-in. inclined belt conveyors, placed side by side, deliver the gravel and sand which has passed through the grizzly and the crushed rock respectively to two 60-in. by 12-ft. revolving scalping screens.



Harris & Hull, Inc., plant No. 1, near Roscoe, Calif. At the extreme left are the seven large storage compartments of about 35,000 tons total capacity

The sand and gravel scalping screen is equipped with 2½-in. and 5-in. perforations, with a sand jacket of wire cloth having ¼-in. square openings. The through 2½-in. product flows to a No. 7 elevator, which delivers it to a 60-in. by 20-ft. jacketed sorting screen over the loading bins for the sized gravel products. The product through the 5-in. perforations of the gravel scalping screen flows to a No. 37 Kennedy-Van Saun gearless reduction crusher and the

oversize to a 16x24-in. Acme jaw crusher which had been the initial breaker of the plant before it was re-built. This crusher and the feeder referred to are the only units of the old plant still in use.

The crushed rock scalping screen is provided with 4-in. perforations throughout. The oversize flows to the 16x24-in. jaw crusher which discharges to a 24-in. horizontal belt conveyor, also receiving the through product from the 4-in. screen perforations and that from the No. 37 gearless crusher. This conveyor discharges to a No. 7 elevator, which delivers all of the crushed rock to a 60-in. by 20-ft. revolving jacketed sorting screen, from which the products are segregated into the shipping bin compartments beneath it. The screen oversize is, by means of a 20-in. belt conveyor, returned to a 100-ton capacity feed bin, from which it is re-crushed by the No. 37 gearless crusher. The sand removed with wash water by the jacket on the sand and gravel scalping screen flows through a launder to a 20-in. by 40-ft. belt-flight inclined drag sand washer, from which the washed sand drops through three outlets to form conical piles of 1000 tons total capacity. This sand storage rests on the ground, and is provided with two tunnels, each having a 24-in. belt conveyor, which serve to load directly into auto trucks.

The through "pea gravel" product from the ⅜-in. square openings of the wire-cloth jacket of the gravel sorting screen is used principally for concrete tile and roofing purposes.

The through product from the ⅜-in. square openings of the wire cloth jacket of the crushed rock sorting screen flows to a Symons shaking screen fitted with wire cloth having ¼-in. square openings, from which the oversize, known as No. 4, is used principally as a top dressing for macadam roads, and the rock dust through product for the top coat of asphalt pavement.

The crushed rock is sized as Nos. 1, 2, 3 and 4, which are minus 4 in. plus 2½ in., minus 2½ in. plus 1 in., minus 1 in. plus ⅜ in., and minus ⅜ in. plus ¼ in. respectively, although this sizing is altered to meet specifications. No. 1 is strictly macadam rock; Nos. 2 and 3 are used principally for concrete pavement and building foundations, and No. 4, as previously stated.

The gravel is produced in two sizes, in addition to the "pea gravel" before mentioned. The coarse is minus 2½ in. plus 1 in. and used principally for paving. The fine gravel minus 1 in. plus ⅜ in., is used for paving and building by being mixed in proper proportions with the coarse gravel.

It will be noted that the plant was designed so as to keep the gravel products free of crushed material and the crushed rock products free of uncrushed gravel, this being sometimes a requisite to meet specifications.

Ground Storage

The segregated products are drawn through bottom draft gates from the plant bins into auto trucks for current shipments, but a surplus of any product is by a system of 24-in. belt conveyors drawn off from any bin compartment and discharged to a 24-in. inclined belt conveyor which terminates at a height of about 50 ft., where it discharges to a 24-in. by 25-ft. horizontal stacking belt conveyor placed parallel to a steep hillside which serves as a natural retaining wall for one side of the storage pile. This stacking conveyor is provided with a self-propelling tripper, so that any of the materials may be discharged into its respective compartment of the ground storage.

These compartments are seven in number of about 35,000 tons total storage capacity.

A reinforced-concrete, auto-truck tunnel 11 ft. wide, 12 ft. high and 308 ft. long extends beneath the full length of the storage pile and is equipped with Kennedy self-closing overhead drawoff gates at frequent intervals, which serve to load directly into auto trucks for shipment.

The tunnel is constructed with concrete walkways, ventilators, electric lighting and drainage pump equipment.

Mixed Aggregates

A four compartment measuring and mixing bin adjacent to the crushing plant serves to provide accurately proportioned aggregates to meet specifications which are loaded directly into auto trucks for shipment.

The plant was designed for a normal output of 1000 cu. yd. or about 1200 tons per shift of 9 hours, but has produced 1500 tons per shift.

The output consists approximately of 45% crushed rock and 25% gravel in sizes stated and 30% of washed sand.

Operating Data

The total power consumption of the crushing plant and ground storage conveyors averages about 1500 k.w.hrs. per 9-hr. shift, all of the machinery being driven from electric motors by unit system.

The operating force consists of the following:

3—Steam-shovel men
3—Track men
3—Locomotive men
3—Car dumpers and grizzly men.
1—Crusher man
1—Screen man
1—Conveyor man
2—Loaders
1—Scale man
1—Warehouse man
1—Mechanic
1—Helper
1—Night repair man

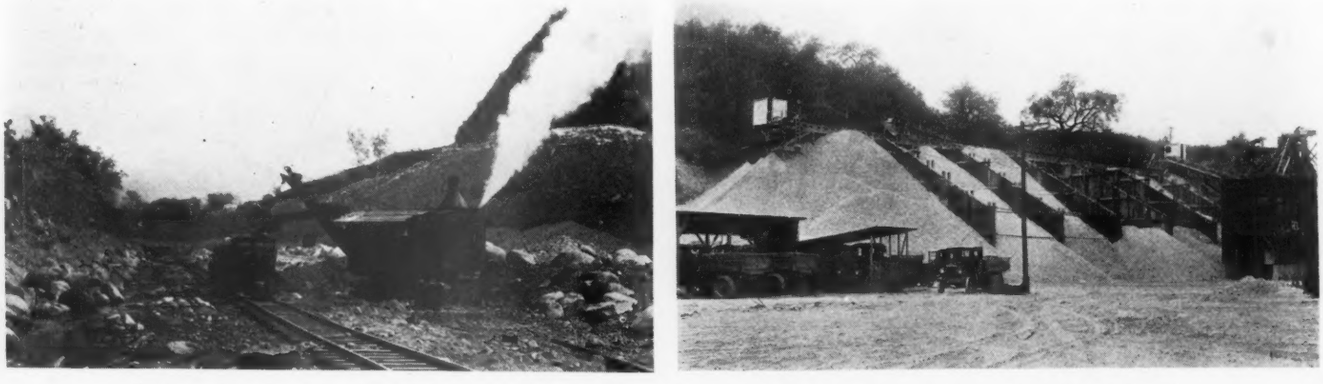
Making a total of 21 men in addition to the superintendent, O. J. Langendorf and plant foreman, A. Johnson.

The plant was designed by the author, who is the Pacific Coast representative of the Kennedy-Van Saun Manufacturing and Engineering Corp. of New York City.

A separate department, located about two miles from the plant, handles the shipments, all made by auto trucks, of which the company owns about 60, mostly six-wheelers of various makes.

This plant is generally recognized as the smoothest in performance of any in this vicinity, in respect to continuity of operation and economical production. The products are well sized, clean and of high quality, so that they are always in demand.

The firm of Harris and Hull, Inc., is headed by J. G. V. Clarke, president and general manager, to whose energy and business sagacity must largely be ascribed its success.



Left—Excavating and loading material at the No. 1 plant. Right—Ground storage department and mixed aggregate proportioning bins

Proceedings of the Tenth Convention of the National Sand and Gravel Association

A Year of Great Progress Since the 1925 Convention, Especially in the Washed Gravel Ballast and Concrete Products Departments

A BRIEF notice of the tenth annual convention of the National Sand and Gravel Association was given in the issue of ROCK PRODUCTS for January 23. This contained a report of the directors' meeting, the names of the officers elected and the report of the executive secretary.

The convention proper began its work on the morning of Tuesday, January 20. It was to have been opened by an address by Governor Walker of Georgia, but the governor was obliged to be absent and a letter from him was read in place of the address.

A Year of Great Growth

President John Prince (Stewart Sand Co., Kansas City, Mo.) began his opening address by giving some figures as to the growth of the sand and gravel industry since the industry was first organized 15 years ago, a growth which is reflected in the growth of the association. He pointed out that the executive committee still had to consider membership and revenue as matters of the first importance but that the increase in 1925 of 33⅓ in membership and 20% in revenue was very gratifying. This was not the result of any "drive" during 1925, but rather of the cumulative effort of previous years. The policy of holding executive meetings in different parts of the country had worked out well in this and other respects.

He spoke of the newly established engineering and research division and in this connection of the similar work of the National Crushed Stone Association. He thought the National Sand and Gravel Association might wish the stone men success in their research work since both associations were only trying to develop the facts as to the use of their materials and a thorough understanding of the facts is the basis of all intelligent competition.

The Western rate case was noted and the discrimination against gravel by New York and Pennsylvania highway departments. He said that it was developing that this discrimination was largely due to a few producers who put out a poor quality of gravel. He wanted membership in the National Association to be a guarantee of the quality of the material produced by a member and said that it was already largely so on account of natural selection.

The work of the gravel ballast committee was commended.

In closing, Mr. Prince warned members that it might be necessary to increase dues as the association was carrying on a great deal of work at a cost which was low compared to what some other associations were spending.

Hugh Haddow, Jr., new president of the National Sand and Gravel Association

Six Good Months and Then?

George E. MacIlwain, a Boston economist and specialist in the preparation of trade statistics was the first speaker. He reviewed briefly the history of the building industry for the past year and showed that the momentum gained would carry the present prosperity forward for six months. After that he expected a slump so that the year would probably close with a record of the usual five billion dollars worth of construction instead of the six billions and over of 1925. He thought prices of many things were out of line and that wages were still too high. On the whole, Mr. MacIlwain's speech had a decidedly pessimistic flavor.

Special Sands As By-Products

W. M. Weigel, who is the mineral technologist of the U. S. Bureau of Mines, Department of Commerce, read a paper on "Special Sands as By-Products from the Average Commercial Plant." He showed that while few plants could produce silica sand for glass making and chemical and metallurgical uses, many plants might produce filler sands, engine sands, stone sawing sands, and the like. His paper was illustrated with some excellent lantern slides.

Cement Products

The cement products section had its meeting on the afternoon of the 20th, and it was well attended. Apparently a considerable number who were not manufacturing products were sufficiently interested to be present. The walls of the room were hung with photographs which A. J. R. Curtis, the first speaker, said represented a mile of concrete houses. Many of these photographs were of beautiful residences recently built in Florida, but all climates and all parts of the country were represented.

Mr. Curtis, who is with the Portland Cement Association, gave an interesting history of the cement products business, which

is over 60 years old and compared its present status with the clay brick industry. He gave some rather surprising instances of the preference for cement products over other materials in building expensive residences. It was new to most of his listeners to learn that cement products had not injured the brick mason's trade but had helped it. He warned his hearers that there was no money in the small products plant today.

Eugene F. Olson, General Manager of the Anchor Concrete Machinery Co., followed Mr. Curtis with an interesting account of the development of the concrete block making machine from the old wooden mold affair of 30 years ago. He also described how the cement products plant mixer had evolved and the changes in the business that had come from the use of handling machinery.

C. C. H. Thomas of the National Stone Tile Co., gave a talk on the sales angle of the products business. He brought out that bulk products could be made from $6 to $8 per yard of concrete and sold for $8 to $15 per yard. The rest of his talk was a discussion of salesmanship and advertising.

E. W. Dienhart, chairman of the section and manager of the Acme Concrete Products and Gravel Co., Cement City, Mich., closed the session with a talk on "Aggregate Requirements of the Concrete Products Industry." Mr. Dienhart is well fitted to speak on this point as his company's sand and gravel plant is mainly engaged in producing aggregate for concrete products. He showed that the gravel, which is thrown away in some places, is worth $6 to $8 a ton as concrete products aggregate, and it is worth it because it *saves that much in cement* when it is properly added to sand used for making concrete blocks. He showed some interesting charts of graded aggregates and strengths.

Thursday's Sessions

E. Earl Glass, who is secretary of the Pacific Coast Sand and Gravel Association, read a paper on selling sand and gravel by the ton as opposed to guessing by the yard. This, as he said, is substantially the same paper which he presented at the San Francisco meeting of his association, which has already been published in Rock Products.

The report of the washed ballast committee followed. It was read by Earl Zimmerman, the chairman, of the Ohio Gravel Ballast Co., Cincinnati, Ohio, and it was evident from the discussion that followed that most of the members believed a long step forward had been taken. More discussion followed this than any other paper or report.

Stanton Walker, the newly appointed head of the engineering and research division, spoke on standardized specifications for sizes of sand and gravel and while he was not ready to make definite recommendations he showed that the need of standardization was apparent.

Reports of Committees

The resolutions committee had only a single resolution presented. This commended the work of local railroad representatives in co-operating with producers in matters pertaining to carload shipments.

The budget committee was composed of Hugh Haddow, J. A. Roquemore, J. E. Carroll, J. L. Shiely and R. C. Fletcher. As Mr. Haddow was absent the report was read by Mr. Fletcher. The budget calls for an expenditure of about $36,000 and it was recommended that dues be not increased, as it was thought that new memberships would be sufficient to make up the difference between this sum and the present income. The report was adopted.

The nominating committee consisted of W. L. Smith, H. E. Schellberg and H. H. Halliday. The nominators were: President, Hugh Haddow, Jr., Menantico Sand and Gravel Co., Millville, N. J.; Vice-President, R. C. Fletcher, Flint Crushed Gravel Co., Des Moines, Iowa; secretary-treasurer, J. L. Shiely of J. L. Shiely Co., St. Paul, Minn. Members of the executive committee: J E. Carroll, J. E. Carroll Sand Co., Buffalo, N. Y.; Geo. A. Rogers, Union Rock Co, Los Angeles, Calif; H. H. Halliday, H. H. Halliday Sand and Gravel Co., Cairo, Ill. For directors at large, H. S. Davison, J. K. Davison and Bro., Pittsburgh, Penn.; J. B. Blanton, J. B. Blanton Sand Co., and John Prince, Stewart Sand Co., Kansas City, Mo., were chosen. George A. Rogers, Union Rock Co., Los Angeles, Calif., was made the director of the new district, No. 26, covering southern California.

The pleasure of the convention was marred by the fact that some of the members were taken down with the "flu" while attending it. T. R. Barrows, the executive secretary of the association became seriously ill and had to be removed to a hospital, Mr. and Mrs. Hugh Haddow were both taken sick, but recovered after a few days.

President Prince's Address

WHILE this is advertised as the tenth annual convention of the National Sand and Gravel Association, there was held in 1911 at the Auditorium hotel in Chicago, an organization meeting of sand and gravel producers. Thus, there developed 15 years ago, the first national effort to organize this industry and out of that effort grew the present association.

During the intervening 15 years, the world has passed through the most tremendous upheaval known in modern times. This country has seen changes more far reaching than any since the Civil War, probably more important than any we have ever known.

Perhaps we have emerged far enough from the effects of the World War to note the changes that have come about since the starting of the association; possibly the violent bends in the economic curve have been strengthened enough to indicate the present position of the industry and the direction it is taking.

During this 15 years the growth of the industry has been marked and the influence of this association has become important to every producer. Production has increased to twice and almost three times what it was 15 years ago and the value is over four times as much. This is because the quality of the product has advanced, due to the greatly increased production of washed sand and gravel.

It is estimated that the geological survey for 1925, will show a total production of sand and gravel of all kinds, prepared and unprepared, manufactured product and pit run of 170,000,000 tons. If all this were used for 18-ft. concrete roads it would build ten roads from the Atlantic to the Pacific and ten roads from Canada to the Gulf. If all this had been loaded in railroad cars, every freight car in the United States, every box car and gondola, bad order and in going condition, would have been loaded and unloaded five times during the year. Of this tremendous tonnage about one-fourth is represented in this association. According to the published report of our Executive Secretary, the association has gained 33⅓% in membership and 20% in revenue during the year.

Following the policy laid down by the last convention, the executive committee has held six open meetings in different parts of the country. To these meetings have been invited the producers of each section. Thus your committee has been able to learn from the producers themselves the particular problems of each section and counsel with many of our members concerning our national problems and the accomplishments of our national association.

In the same way the individual officers and the executive secretary have taken part in other group meetings to make the national association become a living thing to many members evidenced by more than the *Bulletin* and the other printed matter that reaches them.

The second matter of importance that has held the attention of your officers during the year has been the actual establishment of an engineering research division. The need of a national engineering service has long been recognized and would have been established before had the support for it been forthcoming sooner. The future of the industry and the usefulness of the association will be more and more vitally affected by the accomplishment of this division.

Mr. Barrows has secured as head of this department, a man who by reason of his personality, his training, and experience, is peculiarly fitted for the work. After long consideration of the subject and with a full knowledge of what is involved, I must report to you that I know of no man, regardless of professional standing, better fitted

to make a success of this division than Stanton Walker.

To those of you who compete with crushed stone producers, this will bring to mind a similar undertaking recently inaugurated by that association. I believe good business will dictate to us that it is wise to wish them every success in this effort.

Both associations are now actively undertaking to arrive at the facts. When facts are established and recognized between competitors, you have the first and most important basis for an understanding to the advantage of both.

The larger particular problems of the association have been fully covered in the printed report of our executive secretary. A few comments only are necessary.

Western Rate Case

In the Western rate case, a meeting of some of the interested producers was called last September by the National Association. A policy was there agreed upon and a budget proposed. Within two weeks the entire amount necessary, some five thousand dollars, was in hand, and the preparation of the case underway. The National Association had created such a spirit of co-operation and confidence among the producers of the west that the whole case has been prepared and presented, paid for by the western producers and administered by the National Association without having developed serious difference of opinion.

The preparation and presentation of this case could hardly have been improved upon. It cannot fail to have great influence on the rate situation of mineral aggregate throughout the entire country.

However, I should warn you that all this effort may have no bearing on the conclusion of the Interstate Commerce Commission. It is entirely possible, for example that the commission may decide the western roads need increased rates to provide increased revenue and that it will not be good policy to make any exception to the increase.

In such event the commission may not even consider the evidence. Nevertheless the National Association has added an accomplishment to its record, for the confidence developed in the industry through the exercise of this ability to co-operate is worth the price.

In Pennsylvania and New York there has been apparent discrimination by highway departments against the use of gravel for concrete roads. While the producers affected have been organized and a willingness to co-operate developed under the most difficult circumstances, still much of the work of solving this longstanding problem lies ahead for our engineering division. The time required to accomplish this must not be underestimated.

From what I know of the situation it may easily develop that much of the fault lies with one or two producers of gravel in that territory. A producer who is so ignorant or short sighted as to neglect the proper preparation of his material or who refuses to understand the importance to him of specifications prepared to produce the best concrete obtainable, has no right to a membership in this Association.

I believe the time has come when we should refuse membership to a producer who does not market a satisfactory material or who does not make an effort to correct conditions which tend to discredit our product or injure the standing of our members. A notice of membership in this association should be guarantee of fair dealing and a dependable product best suited to the purpose intended. This has already been largely accomplished without conscious effort on our part by a process of natural selection. With the growth in importance of this Association and the more obvious advantages of membership, others not so desirable will seek admittance for the temporary advantage they will gain. If we continue to be watchful for this danger and jealous of our good name, I believe the time has come when we will individually be greatly benefited by the uniform use of the name of the National Sand and Gravel Association in all our individual advertising.

The effectiveness of the long standing policy of this association to develop mutual understanding between producers is becoming evident. While the National Association neither directly nor indirectly concerns itself with price, yet it is self evident that the growth of the larger viewpoint among producers is bound to create business stability and prosperity in the industry.

Stability Increasing

In the annual review recently published by Rock Products this condition is noted: The general price trend has been downward, a condition which is frequently accompanied by disastrous price wars. These serve no good purpose to either the producers or the consumers and have been notably absent in the industry this year. The review indicates that while not all the producers have received a return sufficient to meet the requirements of prudent business methods, yet such conditions have not affected any great tonnage. This is no doubt due to the increased feeling of responsibility in the industry and the appreciation of the broader viewpoint of our business very largely brought about by this association.

The reception given public offerings of bonds and stocks of our members shows the effect on the public mind of stability and sound business methods.

This association is not merely a theoretical organization contributing to the good of its members in a purely abstract manner, but can mean thousands of dollars increased income to the producers who take advantage of it. The splendid work of our gravel ballast committee alone can be translated into large sums by members of this association. Mr. Zimmerman will later cover that in his report, but I mention it here merely to emphasize the importance of the work of the association to its members and the increasing value of that work with the development of our engineering and research division.

This leads directly to the essential position occupied by your board of directors. I urge every member to exercise the most careful consideration in the selection of directors from the different sections of the country. Men of ability in whom you have confidence should always be chosen, for from these are usually selected the officers and members of the executive committee who are directly responsible for the value in dollars of our work to our members.

So far the activities to be undertaken have been governed by the revenue reasonably to be expected. If the board of directors have the absolute confidence of the general membership, they would be supported in first determining the activities which offer the best return on the investment and then making the rate of assessment to properly carry out that plan.

Our association has frequently followed the policies of one of the most successful of trade associations, one closely allied to us, the Portland Cement Association. But let me call your attention to the fact that in order to accomplish so much they now consider it good business to invest each year about 2½% of the net value of their sales of portland cement in their association work, while the activities of our association are carried on with less than one-fourth of one per cent of our net sales or at one-tenth the rate of the Cement Association.

I know of no other trade association that has accomplished so much of value to its membership at so little cost as our association. The reason for this is that we have in Washington a small but effective group of employees and in addition many thousands of dollars in time and expense are donated each year by interested members.

With the end of this convention the present administration will turn the management of the association over to your incoming officers. We see much that has not been accomplished and some few things on which a start has been made. The more one is familiar with the activities of the association the more one realizes the larger possibilities just ahead.

With the changing attitude of government toward trade association and with the better understanding of the public and then more general participation in large business, many see a rapid increase in the importance of such associations.

One very keen observer of the trend of national events, tells me that in his opinion within a few years every important industry in this country will be dominated and controlled largely by its trade association. Every unnecessary over-expansion of an industry, and every wasteful price war so apt to follow, must be controlled in the interest of the public.

If in the future this and other trade Associations are conducted on sound principles with due consideration for all parties, then it becomes most logical that they should be charged with the full responsibility for the conduct of all industry.

Special Sands as By-Products of the Average Commercial Plants*

MOST members of the National Sand and Gravel Association are primarily interested in structural sand which is by far the most important kind from the standpoint of tonnage and value. There are, however, many other grades of sand of considerable importance, some of which would be possible of production at many plants now producing only building and concrete sands. Some of these as for example glass sand, require a high silica content and few commercial deposits worked for structural material can meet the requirements. There are other grades however which it is believed that many commercial plants might find it advantageous to turn out as by-products either as a regular procedure or else at times of slack business in the regular grades.

In nearly all cases it would be necessary to install additional equipment or make changes in the existing flow sheet and the cost of these changes and additional equipment would have to be weighed against the possible returns. Often these changes would not be expensive and would consist of only one or more additional screens with the necessary handling equipment and storage capacity to take care of the special grades produced.

When it becomes necessary to dry the sand, however, the additional cost would be considerable as any kind of drying system that could be installed would be expensive. It would be imperative for the firm contemplating such production, first to investigate the market and determine if it would be possible to produce the marketable grades from the sand available. This investigation would include an inquiry of industries within shipping distances which used sand that could be prepared, the characteristics of the sand used, seasonal requirements, possible outlets for other grades that might be prepared and all other information affecting the market. It possibly would also mean a careful laboratory study of the sand produced including chemical analysis and microscopic study of the character of the individual sand grains and the character of the impurities.

Removing Special Sands from Concrete Sands

One interesting possibility for the commercial sand plant would be where the grade normally produced contained an excess of grains between certain limiting sizes as specified for structural purposes. For example, the American Society for Testing Materials gives tentative specifications for fine aggregate as follows:

Passing ⅜ in. sieve	100%
Passing No. 4 sieve	85%
Passing No. 50 sieve not less than	30%
Weight removed by decantation test not more than	3%

The commercial sand being prepared might contain considerably more than 55% between the No. 4 and the No. 50 sieve. In this case it would be possible to take out part of this and utilize it in the preparation of some special sand. Again there might be more than 30% finer than No. 50 sieve in which event the removal of this excess would improve the grade of the main product and this excess might be used for some special purpose. The A. S. T. M. tentative specifications state that no more than 6% shall be retained on a No. 8 sieve. In case a sand contained in excess of this amount the excess could be screened out and used for some special purpose, for example, the two coarser grades of sand blast sand. The Bureau of Public Roads recommends specifications for sand for concrete roads that are quite elastic as, for example, it is stated that the proportion between a No. 10 and a No. 50 sieve may vary from 50 to 90%. Most special sands fall within these limits so that a preponderance of any close range of sizes within these limits would permit the separation of a considerable portion without impairing the value of the sand for concrete purposes.

Molding Sand

While molding sand is not usually considered a special sand there are so many kinds and varieties of this material that I am sure some commercial sand plants could produce some of the grades. In fact plants are now in operation where part of the output is marketed as core sand or steel molding sand. These of course are washed grades. Most molding sands for work other than steel molding are not washed and their value depends on the natural bonding material in the sand, usually a ferruginous clay. It is possible that some commercial deposits may have parts of the bed, such as portions of the overburden or underlying beds that are unsuitable for structural sands but which might make a good molding sand. The American Foundrymen's Association is carrying on an investigation of molding sand including the collection of information on available sources of both producing and new deposits. Samples may be sent to their research committee for examination.

Two Methods of Making Special Sand

There are two general ways in which special sands may be prepared as a by-product at a commercial plant. In the first a portion of the entire natural sand product is cut out, usually after it has been washed, and special sand prepared from this. In the second method only part of the sand between certain limiting sizes is cut out from the natural sand. Occasionally a combination of these two methods may be used. The first method would be employed where several grades of special sand are prepared and a range of sizes from coarse to fine desired or where the special sand made was itself a product graded from coarse to fine, as some of the abrasive sands like stone sawing and some glass grinding sands. In this method less careful control is required in the first separation from the principal plant product as it does not in any way affect the quality or grading of that.

The second method would be less frequently used and would be applicable only where one or two grades of closely sized sands were desired and where there was an excess of grains of this size in the natural sand. More careful control of operations is required, especially if only a part of the grade within the limiting sizes is to be removed. Natural sands to which this method would apply have been referred to. An Ohio plant is a modified example of this, coarse and fine gravel are washed out on vibrating screens, and the oversize from the last vibrating screen is diverted to separate drainage bins and is a source from which sand blast and special marble and stone sawing sands are prepared. This material has all passed a 3/16-in. square mesh screen and the clay, fines and molding sand removed on a finer screen.

Special Sands Which May Be Prepared

High silica sands could not usually be prepared at the ordinary commercial sand plant but some of the more important which might be produced are: Filter sand, sand blast sand, stone sawing and glass grinding sand, engine sand, flooring sand and various grades of abrasive sands. A brief description of the uses and properties of these different sands may perhaps be of interest.

Engine sand is produced in large quantities. Many of the smaller railroads take what is available without much regard for quality. The better managed roads, however, are careful to specify material suitable for the purpose. The sand should be a washed product, free from foreign matter and any clay coating which might tend to absorb moisture. An excessive amount of fines is objectionable as they blow off the rail and tend to absorb moisture and form lumps. Coarse grains are objectionable as they are liable to choke the supply pipes. A sand high in silica is considered best. Most of the sand used is sharp to medium sharp, but rounded grain sand has been successfully employed. Sometimes the railroads and street car companies take wet sand, preferring to do all the drying themselves but many roads buy dry sand. One large railroad company uses sand at least 97% of which will pass a No. 20 sieve, with not more than 10% passing a No. 80 sieve. Another large railroad uses a sand all of which passes a No. 10 sieve, with 40% retained on a No. 40 sieve and not more than 5% passing a No. 80 sieve. At one plant engine sand is made from the fine material screened from sand blast sand. Specifications in most cases are not rigid and many commercial sand plants could easily prepare a satisfactory product.

*By W. M. Weigel, mineral technologist U. S. Bureau of Mines. Published by permission of the director of the Bureau of Mines, Department of Commerce.

Filter Sand

Filter sand is used in various types of filters for the purification and clarification of water, especially for municipal water supply. Not only is silt and sediment in the water removed mechanically but a good sand filter also removes most of the bacteria. While the total production is not large (about 120,000 tons per year), the best grades command a good price and it can be prepared from most commercial sands of good quality as the chemical requirements are not particularly severe. The physical properties as usually specified appear formidable at first sight and it might seem that the preparation of the sand was a difficult and expensive operation, but this is not the case. The fineness is usually specified by a figure called the "effective size" which means an arbitrary size expressed in millimeters such that 90% is coarser than this and 10% finer, or in other words the size of the opening in an imaginary sieve which would retain 90% of the sand. The grading from coarse to fine is specified by a figure called the "uniformity coefficient." It is an abstract quantity and is the ratio of the size of grain which has 60% finer than this to the size which is 10% finer (or the effective size). If all the grains were exactly the same size the uniformity coefficient dould be 1. The effective size varies from 0.20 to 0.70 millimeters (0.008 to 0.028 in.) or about No. 70 to No. 25 U. S. standard sieve. The more common sizes are, however, from 0.35 to 0.55 millimeters No. 45 to No. 35 standard sieve. The uniformity coefficient varies from 1.25 to 1.80 with 1.55 to 1.65 as an average. A sand then with an effective size of 0.42 mm. and a uniformity co-efficient of 1.40 would have 90% retained on a No. 40 sieve (0.42 mm.) and 40% retained on a No. 30 sieve (0.59 mm.). It is also usually required that at least 90% shall be finer than 2 mm. or pass a No. 10 sieve, and all pass a No. 4 sieve. It is usually specified that the sand must be clean and free from clay and organic matter, a requirement easily met by any good sand plant, also that not more than 5% shall be soluble in hot dilute hydrochloric acid. Lime and magnesia, calculated as carbonates, must not be present in excess of 2%. Practically all plants which produce sand blast sand can prepare filter sand as the requirements are much the same as for No. 1 blast sand, for while some large grains are permissible most filter sands will all pass a 14 to 20 mesh sieve as it is not necessary in most cases to remove most of the coarser material from ordinary sand to get the desired uniformity. Both rounded grain and sharp sand is used.

Sand Blast Sand

Sand blast sand is usually classed as one of the abrasive sands but as it is of commercial importance and has special properties it is here considered as a separate product. While at first used mainly in the foundry to smooth up rough castings it now finds application in many other lines of industry. Some of its uses are, the removal of old paint from wooden surfaces, renovating or cleaning the outside walls of stone buildings, carvings and lettering in stone, marble and granite, finishing iron and steel preparatory to enameling, finishing brass and bronze castings, giving special ground glass finish to plate glass, and numerous other purposes.

Blast sand must be closely graded, perfectly dry, and of fairly high silica content. For this reason it brings a better price than any of the other grades of special sands.

Cutting and Grinding Sand

Sand for stone and marble cutting and grinding and for glass grinding is one of the special sands of considerable importance, the total production probably being in the neighborhood of 2,000,000 tons per year, with an average value of about $1.60 per ton. There are no definite specifications covering this grade as each consumer looks for a sand which meets his particular requirements, and the ideas of the different consumers are not the same. Price and availability are more often the determining factors than otherwise. In general the sand should be fairly pure, free from excess fines and large grains, and made up mostly of tough quartz grains. Some consumers use a uniformly sized sand similar to sand blast sand when it can be cheaply obtained but most of the material used is a product graded from coarse to fine. Almost any good commercial sand plant could produce a satisfactory stone sawing sand if the product does not contain too high a percentage of grains which are not quartz. A large marble company satisfactorily uses a sand for sawing and rubbing of the following sizes; passing No. 8 sieve, 100%, retained on No. 30 sieve 20%, retained on No. 50 sieve 85%, passing No. 100 sieve 2%. A large plate glass company uses a grinding sand all of which passes a No. 20 sieve with 80% retained on a No. 100 sieve and 2% passing a No. 200 sieve. It takes about 3 tons of sand to grind a ton of plate glass. Both rounded and angular grained sands are used.

Flooring Sand

Flooring sand as here considered constitutes part of the aggregate in asphalt mastic flooring which consists of a sand and fine mineral filler aggregate with asphalt cement binder. As far as tonnage goes it is not an important grade. No chemical analysis is specific but the sand should be clean and free from clay and silt. It should all pass a No. 3 sieve, with a maximum of 60% through a No. 8 sieve and not more than 8% passing a No. 100 sieve.

Possibilities of the Special Sand Business

The producer of structural sand, unfamiliar with the preparation and marketing of other grades, may well raise the question as to the desirability and practicability of investing in new equipment and being bothered with the additional supervision required to prepare special grades, but as the cost of mining or excavating and preliminary washing and screening are not in any way increased, a knowledge of the difference in price obtained for the two classes should certainly cause a more careful study to be made of the possibilities. In 1924, the average selling price at the plant for building and paving sands was about 56½ cts. per ton while that for the group including filter, engine and all forms of grinding and polishing sands was about $1.10 per ton or nearly twice that of the commercial grades. If sand could be sold for the former figure at a profit, and we must assume that the average plant operated at a profit then even the additional cost of special preparation should leave a still better percentage of profit at the higher figure.

Report of Washed Gravel Ballast Committee

YOUR committee charged with the promotion of washed gravel for railroad ballast is pleased to report what we believe to be substantial progress. A number of meetings were held during the past year. Five of these were held jointly, with the general ballast committee of the American Railway Engineering Society, at the following places: Pittsburgh, May 28; Chicago, July 10; Montreal, Sept. 17; Washington, Nov. 5; Chicago, Nov. 20.

As a result of our efforts and of the spendid co-operation of the general ballast committee of the A. R. E. A. a specification for size and grading of gravel railroad ballast has been prepared, which we believe will be to the advantage of all producers in the United States and Canada, as well as to that of the railroads. This specification, which will be described below, probably will be adopted as a tentative standard for one year by the American Railway Engineering Association at their general meeting next March. The general ballast committee of that association expects to continue their researches on this problem during the ensuing year. They will determine upon provisions for factors other than size and grading, such as abrasion, toughness, etc., and they hope to create a complete specification which will be adopted as the standard of their association. It is the opinion of your committee that the tentative provisions for size and grading will be included in the standard specification without important changes.

Personnel of Committees

Your washed gravel ballast committee consisted of the following members: Earl Zimmerman (chairman), F. D. Coppock, M. H. Neville, Alex W. Dann and J. E. Carroll.

The American Railway Engineering Association will, of course, have the final decision as to the nature of the specification adopted and our work was necessarily, therefore, in close co-operation with their general ballast committee.

The A. R. E. A. is composed of engineers

engaged in construction and maintenance of railways throughout North America. The personnel of their 25 or 30 standing committees is composed of engineers of the highest standing and their general ballast committee ranks high among them.

The chairman of the general committee is F. J. Stimson, assistant chief engineer maintenance-of-way, Pennsylvania R. R. Their sub-committee on gravel ballast is composed of the following: C. E. Dare, chairman, chief engineer, Richmond, Fredericksburg and Potomac Railway Co.; C. P. McLaren, Canadian National Railways; J. G. Bloom, Chicago, Rock Island and Pacific Railways; H. N. Huntsman, Wabash Railway; A. H. Woerner, Baltimore and Ohio Lines West.

Your committee wishes to express its appreciation for the splendid co-operation accorded us by the A. R. E. A. committee. Its members showed an unusual interest in building a specification for gravel ballast which would be suitable to the producers of sand and gravel and at the same time meet the requirements of the railroads.

Requirements for Railway Ballast

The principal requirements for railway ballast may be summarized as follows:

Adequate initial drainage.
Support of track structure.
No upheaval by frost.
Adequate cushion for track.

Absence of harmful quantities of fine sand, dust, dirt or loam to insure a dustless roadbed.

Of such nature as to permit bringing the track to the proper line and grade with a reasonable expenditure of effort and a minimum expense.

In the past gravel ballast has been attacked by producers of other ballast materials and by certain railway engineers on the basis that it was responsible for a dusty track when fast trains were moving. Some railroads, we believe, have made "A Dustless Roadbed" a feature of their advertising; the ballast named in that connection was not gravel. Our proposed specification on gravel ballast precludes the possibility of a dusty roadbed due to the ballast, and should do much to counteract such discriminatory advertisements. To the mind of your committee it guarantees a dustless roadbed more conclusively than any other kind of material being used today.

Attacks based on dusty road-beds have been to a great extent, however, the result of a misconception. The principal sources of dust are road and street crossings at grade, streets upon which tracks are located through cities and towns, highways parallel to the railroad and similar sources. Fast moving trains create a tremendous suction which draws in the dust from the surrounding territory. The result is the same, needless to say, with whatever ballast used. We can state as a fact that clean gravel ballast containing as much as 20% of sand finer than 1/10 in. creates no more dust, if as much, than other kinds of material.

Specification for Size and Grading of Gravel Ballast

The specification for gravel ballast, which follows, was evolved after a thorough consideration of the nature of gravel deposits throughout the country, the nature and general methods of producing sand and gravel, and the kinds of machinery in use. It should be emphasized that at no time did the representatives of the railways show a disposition to dictate a specification on any other basis.

During our first few joint meetings it was agreed that, on account of the great variations in gravel deposits throughout the country, it was not practicable to adopt a single universally applicable specification, except to govern general conditions such as cleanness, foreign matter, top and bottom sizes, range of intermediate sizes, etc. It was considered practicable, however, to fix a standard or ideal specification to guide the producer and the railway engineer. Our conception of such a specification is given below and it seems to your committee that it is so flexible, provides for such variations in maximum and minimum quantities of certain sizes and for the addition of varying amounts of crushed material, that all producers can manufacture a ballast satisfactory to the railroads if his deposit is worthwhile for anything else.

Following is that portion of the general specifications for washed, screened and graded gravel ballast pertaining to size and grading, adopted by the General Ballast Committee of the American Railway Engineering Association.

Where Crushed Material is from 0 to 20%			
1/10-in. to	¼-in.	Minimum 25%	Maximum 40%
¼-in. to	½-in.	Minimum 20%	Maximum 30%
½-in. to 1	-in.	Minimum 20%	Maximum 60%
1 -in. to 1½-in.		Minimum 0%	Maximum 35%
Where Crushed Material is from 20 to 40%			
1/10-in. to	¼-in.	Minimum 10%	Maximum 30%
¼-in. to	½-in.	Minimum 20%	Maximum 35%
½-in. to 1	-in.	Minimum 20%	Maximum 60%
1 -in. to 1½-in.		Minimum 0%	Maximum 50%
Where Crushed Material is more than 40% and not less than 95% is retained on a ¼-in. screen			
¼-in. to	½-in.	Minimum 20%	Maximum 35%
½-in. to 1	-in.	Minimum 25%	Maximum 60%
1 -in. to 1½-in.		Minimum 5%	Maximum 55%

Note—Grading to be governed by laboratory tests using screens with circular openings.

Note—A general rule will recite that 98% shall pass a 1½-in. circular opening and that the tolerance of sand under 1/10-in. will be 3%.

Further Work of the Committee

In addition to our work on the specifications for size and grading, arrangements were made (at the Montreal meeting) to submit to the railway engineers data of tests for abrasion and toughness of gravel, from which they could formulate requirements to be incorporated in their complete specification. Provisions for abrasion and toughness were suggested by your committee for the purpose of pointing out the real value of gravel ballast from a quality stand-point, to prove to the railroads the real service it would provide and to show that this factor is of first importance.

Accordingly, arrangements were made with the Pittsburg Testing Laboratory to carry out tests on samples from representative producers of gravel ballast, as well as a few comparative tests on crushed stone. This laboratory was selected because of the excellent reputation which it enjoys throughout the United States and Canada, and since facilities in our own organization were not available.

The results of the tests are included in the printed report which forms an appendix to this report and which you have before you. No discussion of these tests is included here. They are being sent to the railway committee and will, we are sure, receive their full consideration before being used as a basis for specification.

Summary

It should be unnecessary to point out to producers of gravel ballast, or to those who may enter the field, that your committee assured the representatives of the railroads that if they would give us a hearing in their conferences on specifications, with a view to making it possible for us to deliver gravel ballast in large quantities, that we would deliver material according to specifications. It is "up" to each individual producer to back your committee's promise in this respect. If this branch of your business is to grow to the extent that it deserves, you must produce material as nearly as possible in accordance with these specifications.

In the past some of us have paid a lot of attention to the manufacturer of material for concrete, and very little to ballast. There were times when material unfit for usual purposes was regarded as ballast and was shipped out without regard to quality. Ballast can no longer be considered as a dumping ground for waste material; railway engineers are considering ballast strictly from the viewpoint of its suitability as regards drainage, durability, wear, cost of application and maintenance and first cost.

Your committee feels that an opportunity has been opened to you, and that if you will prepare ballast according to these specifications, that you will not only provide a greater and more stable market for your material but will soon prove to railway engineers the advantages of gravel over all other kinds of ballast. We hope that each producer will prove to the American Railway Engineering Association that he is as much interested in furnishing a ballast of high quality as your committee represented members of this Association to be. A full discussion of these specifications will be most helpful.

In closing we wish to express our appreciation of the interest shown in the work of this committee by members of the association by giving their views of the specifications and by submitting numerous samples for tests and to President Prince and Mr. Barrows for their attendance and helpfulness at some of our meetings.

[A review of the tests mentioned in the report shows that gravel compares favorably with stone in toughness and resistance

and abrasion. Sixteen gravel samples were tested. These came from New York, Ohio, Indiana, Pennsylvania, Virginia, Minnesota, Missouri, Illinois, Texas, Louisiana and Tennessee.]

Discussion

Considerable discussion followed the reading of the report. Some opposition to its adoption developed, which was expressed by E. GUY SUTTON, secretary-treasurer of the Neal Sand and Gravel Co., who said:

"I think the gravel ballast committee is to be commended for the work that it has done, and the great advantages to us in promoting the general use of gravel for ballast.

"I am wondering, however, if the committee believes that it has got a liberal specification for ballast, and one that can be followed at the price that the railroads are usually willing to pay for ballast.

"Now, it is true, I think, that all of us have various grades of material that really are not acceptable for ballast, but, on the other hand, the railroads have only been willing to pay a price that would permit us to furnish a low grade of material. The first specification there, where the crushed rock runs from nothing to 20% is a specification that is, with the exception of the amount of sand it may contain, is as hard to follow as the specification for concrete gravel in Illinois. It only permits a maximum of 30% for ¼ and ½ in., and that is exactly the specification for the Illinois commercial material. And it is that material, especially in Ohio, Indiana, and Illinois that gives us the trouble. I think our deposits run as high in gravel content as any in Indiana, but if we meet that specification we would have to remove a waste of between ¼ to ½ in."

Mr. Zimmerman said the committee could not take prices into account and the railroads' ballast committee had said specifically that they did not meet to consider prices, but to draw up specifications. It was his opinion that the first step was to produce a thoroughly satisfactory ballast; after that was done the price could be determined. A number of speakers followed and all seemed to be of the same mind.

The committee's report was accepted, and the committee continued to carry on the work.

Should the National Sand and Gravel Association Promote Standardized Specifications for Sizes of Sand and Gravel?*

THE purpose of this paper is not to attempt to settle at this time the question of what should be done in the matter of standardization of sizes of sand and gravel, but rather to invite discussion of the subject in the hope that information will be brought out which will be helpful to that end.

The term "size" is often used loosely to refer to the grading or classification of sand and gravel more definitely than to its actual dimensions. For example, material for reinforced concrete work is often referred to as 1-in. gravel, and means aggregate graded from 1 or 1¼ in. down to perhaps ½-in., ⅜-in., ¼-in., or whatever may be the local custom. In this paper "size" refers to screens of sieve sizes used for separation at the plant and for specifications of grading. It is not at once obvious why one producer should make one of the top sizes of his gravel 1-in. while another producer, perhaps in the same town, has 1¼ in. for his top size. No good reason is at once apparent why Committee C-9 on concrete and concrete aggregates of the American Society for Testing Materials should base their recommendations for sieve analyses of aggregates on the square mesh sieves shown in Table 1, while Committee D-4 of the same Society should recommend slightly different square mesh sieves for fine material and screens with circular openings for coarse material.

Standardization of these features is undoubtedly desirable. There seems to be no economic or technical reason why there should not be uniformity in this respect. Time will bring it about, but time will be greatly aided in its work if the members of the National Sand and Gravel Association will lend their help.

TABLE 1

Sieves for Analyses of Aggregate

Sieves recommended by Committee C-9 of the American Society for Testing Materials in "Standard Method of Test for Sieve Analysis of Aggregates for Concrete"

Sieve Number or Size in Inches	Sieve Opening		Wire Diameter		Tolerance, Per Cent			
					Average Opening	Wire Diameter Under	Wire Diameter Over	Maximum Opening
	mm.	in.	mm.	in.				
No. 100	0.149	0.0059	0.102	0.0040	6	15	35	40
No. 50	0.297	0.0117	0.188	0.0074	6	15	35	40
No. 30	0.59	0.0232	0.33	0.0130	5	15	30	25
No. 16	1.19	0.0469	0.54	0.0123	3	15	30	10
No. 8	2.38	0.0937	0.84	0.0331	3	15	30	10
No. 4	4.76	0.187	1.27	0.050	3	15	30	10
⅜-in.	9.5	0.375	2.33	0.092	3	10	10	10
¾-in.	19.0	0.75	3.42	0.135	3	10	10	10
1-in.	25.4	1.00	4.12	0.162	3	10	10	10
1½-in.	38.0	1.50	4.50	0.177	3	10	10	10
2-in.	50.8	2.00	4.88	0.192	3	10	10	10
3-in.	76.0	3.00	6.3	0.25	3	10	10	10

[1]The requirements for sieves No. 100 to No. 4 conform to the requirements of the U. S. Standard Sieve Series as given in U. S. Bureau of Standards Letter Circular No. 74. The liberal tolerances will permit the use of certain sieves which do not exactly correspond to the numbers given in the table.

Producers Should Use Standard Sieves

When a local specification for sand and gravel is being drafted, let each producer in that territory interest himself in seeing that a standard set of sieves is used. For this purpose, the square mesh sieves suggested by Committee C-9 of the A. S. T. M. and adopted by the Joint Committee on Concrete and Reinforced Concrete is recommended for your consideration. (See Table 1.) While it might be difficult to point out in what way this set of sieves is better than others recommended by equally competent agencies, it does represent a standard, and probably the one which has been most generally adopted throughout the country. These sieves (at least those lower than ⅜ in.) were suggested by the U. S. Bureau of Standards after a careful study of the subject. They have the advantage of a logical and systematic arrangement of sizes. A study of the table will show that, except for the 1 and 2-in. sieves, the clear opening of each sieve is double that of the next smaller one. Another reason for the use of these sieves is that they facilitate the computation of the fineness modulus, which will be discussed briefly further on in this paper.

The selection of standard sieve or screen sizes for use in the manufacture of the product and the "bin sizes" which each manufacturer should produce is a part of the same problem. All manufacturers cannot, obviously, produce all sizes, but those which he does produce should conform as nearly as possible to some accepted standard. Perhaps the recommendations of the Joint Committee on Concrete and Renforced Concrete for size and grading of coarse aggregate, which will be discussed below, will serve as a basis for constructive thought along these lines (see Table 3).

It would seem desirable for the National Sand and Gravel Association to appoint a committee to study the question of standardization of manufactured sizes of sand and gravel as well as of sieve sizes used in specifications for grading. If such a committee is appointed, the engineering and research division will be glad to co-operate with it in every way possible.

Standardization of Grading of Sand and Gravel

The standardization of grading of sand and gravel does not permit of as ready a solution as that of sizes. This should, in general, be an independent problem in each locality. It should have no other basis than a thorough study of the sand and gravel produced in the respective localities. To specify gradings which would necessitate wasting too large a proportion of the natural de-

*By Stanton Walker, director, engineering and research division, National Sand and Gravel Association.

posit would be economically unsound. What constitutes "too large a proportion" can be determined only from a careful study of the grading of the material and the effect of variations in the grading on the quality of the work in which it is to be used.

Such study will be greatly facilitated by the standardization of manufactured sizes of sand and gravel. An example of the confusion caused by the lack of uniformity in manufactured sizes in one locality was experienced recently during the preparation of specifications for aggregate for a large public works to be erected in a prominent city. The engineer in charge of writing the specifications collected and tested many samples of sand and gravel from work under way, in an effort to obtain information which would enable him to prepare an intelligent specification for grading which could be met economically by the established producers in that locality. The manufactured product which he sampled varied over such a wide range, particularly in the case of the coarse aggregate, that it was only with extreme difficulty that a satisfactory specification was evolved.

Specifications for Aggregate

While connected with the Structural Materials Research Laboratory of the Portland Cement Association, I was called upon in numerous instances to assist in the preparation of specifications for aggregate for concrete. In such cases the paramount question was always "What is the nature of the material produced in that locality?" This question cannot be ignored if the work is to be done on a sound economic basis. Do not understand from this that any letting down of the bars on "quality" is being recommended. The most rigid control of the uniformity of the grading, which can be attained only in a well designed manufacturing plant, is essential if proportions of materials which will give the desired quality are to be selected intelligently.

A convenient form of specification for grading of sand is that recommended for fine aggregate for concrete by the Joint Committee (see Table 2). The percentages in the table are not a part of the specification but it is recommended by the Committee that they be used wherever practicable.

Table 3 gives sizes and gradings of coarse aggregate recommended by the Joint Committee which should furnish a convenient form for specifications and offer some suggestions for selection of standard sizes.

Selection of Grading of Aggregate

A brief discussion of methods of selecting the most economical grading of aggregates for concrete should be of interest at this time. In the field of concrete, where of course the greatest amount of our material is used, researches carried out in the past few years have provided definite information which furnish a basis for the selection of proportions. Professor D. A. Abrams has conducted at the Structural Materials Research Laboratory what is undoubtedly the most comprehensive series of investigations which have ever been carried out on concrete aggregates. The results of his investigations, which have been confirmed in all of their essential features in many other laboratories, have furnished us with two extremely valuable tools to assist us in the intelligent use of our material—sand and gravel.

These are the "water-ratio" method of proportioning concrete and the "fineness modulus" method of measuring the grading of aggregate. Time permits of only a most limited discussion of these factors.

Water-Ratio

The water-ratio method of proportioning concrete* has for its basis the fact that the strength of concrete is fixed by the quantity of mixing water expressed as a ratio to the quantiy of cement. So long as the concrete is workable and the aggregates are clean and structurally sound, the quantity of cement, the consistency or plasticity of the concrete, and the grading of the aggregate affect the strength of the concrete only in-so-far as they affect the quantity of mixing water required. The general recognition of this fact will be the greatest boon to the established sand and gravel industry that has ever occurred, as will be demonstrated, it is hoped, in what follows:

Since the essential factor in concrete, so far as the strength and similar features are concerned, is the water-ratio, it follows that it is this factor which should be most definitely specified, instead of the proportions of cement, sand and gravel. Provisions for limiting the quantity of mixing water occupies a prominent place in all modern specifications. Still more definite limitations are desirable and in at least one specification (proposed by F. R. McMillan and myself in a paper before the American Society of Civil Engineers in October of last year) the water-ratio, expressed as gallons of water per sack of cement, was the only factor of the proportions which was specified. This specification was successfully put into practice on a reinforced concrete job in Chicago.

Such a specification at once places a premium on uniform well graded sand and gravel aggregates and points out their advantages more forcibly than has ever before been the case. The contractor at once learns that it is not feasible to operate under such a specification unless he receives materials, the uniformity of grading of which can be depended upon. Immediately fluctuations in the grading occur, the workability of the concrete varies over such a wide range that the proportions must be changed. Such changes not only hopelessly interfere with the routine of the job, but also make the question of costs of materials so uncertain that intelligent bids cannot be made. Therefore dependable, uniform materials are essential, and can be obtained only from established producers, such as those who compose the membership of this Association.

Under this form of specification, well graded materials will be insisted upon as never before. The better graded the aggregate the less cement will be required for a given water-ratio and condition of workability, and economy will demand the use of the best graded material available. And I venture the opinion that gravel aggregates will be given preference as never before because its well known advantages with respect to workability will not only permit greater economy in handling, but may also permit the use of more economical mixtures.

The water-ratio method of proportioning concrete, therefore, offers a ready means of determining what proportions of sand and gravel will be most economical.

TABLE 2
Grading of Fine Aggregate

Passing through No. 4 sieve	not less than 35% by weight
Passing through No. 50 sieve	not more than 30% by weight and not less than 10% by weight
Weight removed by decantation	not more than 3% by weight

TABLE 3
Size and Grading of Coarse Aggregate

Nominal Maximum Size of Aggregate, in.	Percentage by Weight Passing Through Standard Sieves with Square Openings						Percentage Passing, not more than	
	3 in.	2 in.	1½ in.	1 in.	¾ in.	½ in.	No. 4 Sieve	No. 8 Sieve
3	95	..	40–75	..	..	..	10	5
2	..	95	..	40–75	..	..	10	5
1½	..	..	95	..	40–75	..	10	5
1	..	..	..	95	..	..	10	5
¾	..	..	..	..	95	..	10	5
½	..	..	..	..	..	95	10	5

*A comprehensive discussion of this subject was given in "Water-Ratio Specification for Concrete" by McMillan and Walker presented before the American Society of Civil Engineers at Montreal in October, 1925. This paper will probably be published in the near future in the Proc. of the A. S. C. E.

Fineness Modulus

The fineness modulus method of measuring the grading of aggregate is a most useful corollary to the water-ratio method of proportioning concrete.

The fineness modulus is the sum of the percentages in the sieve analysis divided by 100, when the sieve analysis is expressed as percentages coarser than the sieves in Table 1, except the 1 and 2 in. sieves. For a complete discussion of this factor see Bulletin 1 of the Structural Materials Research Laboratory, "Design of Concrete Mixtures," by Duff A. Abrams. Brief discussions are also given in the June and July issues of the *National Sand and Gravel Bulletin.*

Coarsely graded aggregates are indicated by a high fineness modulus; fine, poorly graded aggregates by a low fineness modulus. Within the limits of workability the quantity of mixing water required for concrete decreases, and hence the strength increases, and the fineness modulus increases.

Professor Abrams points out that for the range of conditions in which we are principally interested the quantity of mixing water in concrete is governed by the fineness molulus, and that therefore differently graded aggregates which have the same fineness modulus have equal concrete making properties. This factor becomes therefore a most valuable tools in comparing the relative merits of different gradings of aggregate, and has great possibilities as a basis for specifications.

The fineness modulus should also prove useful in solving problems of the industry aside from those connected with concrete, but that is a phase which will not be discussed at this time.

Other Measures of Grading

The surface area, the surface modulus, voids, and fixed sieve analysis (Fuller's curve for example) have been proposed as measures of the grading of aggregate. All of these methods possess merit. However none of them permit of as simple application as the fineness modulus, nor have the relations been worked out so completely. A discussion of them is, therefore, omitted from this paper.

Summary

This discussion may be summarized by the following:

(1) The National Sand and Gravel Association should promote the use of standard sieve sizes in specifications for grading of aggregate and in the manufacturing process and should form a committee for the purpose of studying this problem.

(2) The selection of the best grading of sand and gravel is, in general, a local economic problem, and should be done only after a careful study of materials marketed by the established producers.

(3) The water-ratio of proportioning concrete and the fineness modulus method of measuring the grading of the aggregate are most valuable tools which may be used to advantage in the selection of the most economical grading of sand and gravel to be specified.

Work of Engineering Department

Before closing, I wish to discuss informally and very briefly some of the work which the engineering and research division sees ahead of it.

(1) We conceive as our most important function that of furnishing a definite personal engineering service to the membership. Perhaps we can suggest changes in grading which will be to the betterment of your product; or we may be able to advise you on tests which you wish to have carried out and assist you in the interpretation of the results. Numerous problems of an engineering nature will undoubedly present themselves to you. We hope that you will call on this division of the National Sand and Gravel Association freely and often. It is only in this way that we can become more familiar with the problems of the industry, and thus increase our usefulness to it.

(2) We feel that we should maintain close contact with the users of our material, and insofar as possible guard against its misuse so that the good name of sand and gravel will never be questioned.

(3) We should take an active part in the work of technical societies which have to do with our materials in any way, in order that the view-point of our industry may be properly presented.

(4) We should work toward removing any prejudice which may exist against the use of sand and gravel where it properly should be used, and combating any misinformation which may be spread concerning it.

(5) The preparation of articles for the dissemination of information concerning the proper use of our material should be an important phase of our work.

(6) We should study the problems of the industry so that we may be of maximum service to the members of the National Sand and Gravel Association.

In the brief time which I have been with your organization I have had pointed out to me so many paths of service, so many things that ought to be and can be done, that I go into this work very humbly, but with great ambitions for the future.

Concrete Products Division

AT THE meeting of the concrete products division of the National Sand and Gravel Association, Mr. Dienhart, the chairman, first introduced A. J. R. CURTIS of the Portland Cement Association, who spoke of the 500 kinds of cement products made and the groups into which they were divided, and then said:

"Just about sixty years ago two stone masons in one of our large mid-west cities made the first concrete blocks; at the same time two immigrants coming to America started the first concrete pipe plant that was a commercial success. Since that time there have been remarkable changes.

"This industry has been allowed to, more or less, shift for itself and only the last five years—until five years ago, it had never had a great amount of scientific study. Five years ago Mr. Dienhart assisted in making a survey of the concrete building products and we found that 50,000,000 blocks were being used in the United States that year. The following years there were 175,000,000, the next, 285,000,000, and in 1925, 605,000,000—more than twelve times the output in 1920.

"You might think that because this industry has, in a few years, reached a point where it is running neck to neck with the clay brick industry, that the possibilities for the future might be limited, but this is not so. In the house field, all-masonry houses only go into something between 11 and 14% of the houses built at the present time; the rest are built of frame.

* * *

"The important point is that they have gone far enough to provide walls and put in fireproof floors, partitions and construction. That offers another great outlet. The concrete floor is a good thing. The practicality will not occur to you unless you have given it some study. Most women would shudder at the thought of a concrete floor, thinking of the somewhat poor looking work that you get in concrete sidewalk construction. There is no need of having that in the floors."

Mr. Curtis here outlined a plan of using concrete floors covered with different materials according to the use to which the room was to be put.

"If we only increase the demand by 10 or 20% it would have a very fine effect on keeping up the morale and wages in the industry. We have had about 100% increase in masonry work, which indicates what that industry has been doing. The reason why we are successful today in introducing concrete masonry units is for the following speakers to say, but I want to point briefly to a few reasons."

Mr. Curtis spoke of the study the Portland Cement Association had made of cement products on which $11,000,000 had been spent. He then said:

"The job, then, was to turn ourselves to discovering scientific methods in developing a fixed-quality product at the lowest possible cost. The six principles upon which we depended for doing that

were: (a) to watch and study the great issue of the aggregate, proper gradation; (b) see that we used the right amount of water; (c) the proper amount of cement; (d) right amount of mixing; (e) efficiency of the molding or casting process; and (f) efficiency of curing methods. These six points are the ones which control the quality of concrete masonry.

"We have gone far enough to know how to control these six factors and then we can control quality. Consequently, we are able at the present time to manufacture in these plants standard quality materials, and the quality is uniform.

* * *

"One typical quality which we have succeeded in making uniform and which is opening the way to much larger things is suction. We have been talking recently about the absorption of these units, being the amount of water the unit would absorb if immersed twenty-four hours, and the gain in weight while under water would measure its absorption. In reality, when we are able to make a block or tile which is strong enough to pass the requirements we are unlikely to get the material so that the absorption would raise to a higher figure, but what we are interested in is that the suction should be right. The importance of getting the suction right is this: When you are laying your blocks in the mortar they blend properly. When you start to put on stucco it takes it uniformly—same suction one part of the wall as in any other. That is impossible with any other material.

* * *

"I believe that we are just seeing the dawn of a stucco era. Architects are using brick; we are accustomed to seeing it, but brick really does not satisfy the demand in many particulars. The darker colors are sombre, dull, morose, compared with lighter and brighter colors which you can get so easily with good stucco. You can get any color in any texture you want in stucco.

* * *

"There is a demand and opportunity for many of you men to get into the concrete products business as an outlet for some of your material. Four-fifths of the plants in the country are inconsequential; the other fifth manufactures more than 80% of the product at the present time. You can't make any money by going into it on a small scale, but if you are in a locality that isn't being well served at the present time you owe it to yourself to make a survey of the possibilities."

Mr. Curtis then called attention to the pictures he had hung on the walls which represented a mile of concrete houses. Other pictures showed textures of Portland cement stucco.

Discussion

MR. POTTS (Waco, Texas): What is the measure or value of suction?

MR. CURTIS: There is not at the present time any standard value for that, but we use the method of simply immersing the block in water. The block which can be immersed in water for 24 hours and come out without absorbing more than 10% of its weight, is assumed to be all right. Such a block has a suction which is satisfactory for the taking of stucco. It is not a direct function, but at the same time that is the closest we can get to it. The important part is, if you are within a certain range, is to have your suction just the same. If 4% was a good suction and 8% was the other limit, your suction might be anything between 4 and 8%. We should have a more definite measure than we have got, but as it works out the plasterer goes ahead and treats the whole thing accordingly, after knowing what the suction is.

MR. GREENFIELD (Atlanta, Ga.): How about the possibilities of cinder or clinker blocks?

MR. CURTIS: Cinder block has very great possibilities. I think what appeals to you first is the light weight; whereas the standard concrete block weighs 50 lbs., the cinder block weighs 36 or 37 lbs. Haydite produces a block 33 lbs. The cut-ability is also good.

Development of Cement Products Machinery

Chairman Dienhart next introduced Eugene F. Olson of the Anchor Concrete Machinery Co., who said in part:

"I was raised on concrete products and the machinery for making them. I remember well that first cement block machine that my father purchased and set up for business under an old shed roof. It was called the Miracle machine, and it *was* a miracle. Very fine sand was used, cement was added in liberal proportions, and then an absolute minimum of water put in the mixture. You see, the less water they used, the smoother the blocks looked. Then the laborious hand tamping process took place. One job that went bad was investigated, and it was found that these blocks were made in the late afternoon, and after that the careful buyer asked for blocks made in the morning.

"The significant thing is that practically all of those early cement block jobs are in good shape today, in spite of the manner in which the blocks were made. With all their lack of equipment and knowledge, they made a product of which we need not be ashamed. Those old buildings indicate what everlasting characteristics the modern cement blocks, brick or tile, must have.

"But, following this early period when cement blocks were a novelty, when they were made honestly, according to the best knowledge available at the time, there came a period of a few years when cement blocks were produced of which we cannot be proud. And it is these poorly made, cement-starved blocks that rapidly crumbled away, soaked water and quickly became discolored, that gave the cement products industry the black eye and the reputation which we have only in late years become able to completely live down."

Mr. Olson then gave an interesting history of the development of the concrete block machine beginning with wood molds and passing through the face down block machine to the stripper. He then said:

"The number of machinery manufacturers has been reduced to a very few recognized leaders. It is now possible for men like you, interested in going into the cement products business, to receive without charge a call from a capable sales engineer who will get your ideas, study your conditions, take this information back to headquarters and submit to you—still without charge—complete blueprints for your products plant. Several machinery manufacturers are now quoting on complete operating plants of given capacity including building and everything necessary to conduct the business. We no longer apologize for the cement products machinery now available and I believe that the service in connection with this machinery is comparable to that in any other phase of the building industry.

The Sales Angle of Cement Products

Mr. Olson was followed by C. C. H. Thomas of the National Stone Tile Co., who spoke on sales and advertising. A digest of his paper is reserved for later publication. The last speaker of the session was the chairman, E. W. Dienhart, of the Acme Concrete Products and Gravel Co., Cement City, Mich. Mr. Dienhart said in part:

"In our own plant I will venture to say that in the next two years we will be out of the general field of sand and gravel as most of our producers find our market. I am going to specialize in preparing aggregates for the manufacture of concrete products because our pea-gravel (¼ to ½ in.) that around most of our plants is a nuisance, and about which we are fighting with highway officials all the time, is worth from $6.00 to $8.00 per ton. It is worth that much because its use in concrete will reflect that equivalent in saving of Portland cement to make a concrete product of a given strength. I wish that more of us would study that field and go into it.

"Of the 600,000,000 units made last year it took 12,000,000 tons of sand and gravel to produce. Probably 11,000,000 were of sand and the rest gravel. This industry needs small pebbles.

"I am going to base my talk, gentlemen, upon this bulletin of the Portland Cement Association. Here is a text book on the manufacture of concrete products. *I don't know of another business today that a man can get into and have someone give him all the dope as to how to go about it.* There has been someone who was interested enough, from a selfish viewpoint, in the sales of its own material, to make these studies. This booklet has 17 pages dealing with the six fundamental factors which control the strength of concrete as compared with other materials. Ten of these pages are exclusively devoted to the aggregates. That is because the aggregates are the most important of those six and the most difficult to control. If we can get this dope before the concrete-products potential customers in our territory they can profit immensely by it.

"It is an important matter when an organization will go out and make research when they know that they are going to *show how to use LESS cement.* The Portland Cement Association today is showing general users how to use a minimum amount of cement. Solely because cement is the most expensive material which goes into units, and they know the more economical they can get these units, the more will be marketed. They are opening a wonderful field for us to capitalize on that work.

"I recommend this booklet—take it and study it.

The remainder of Mr. Dienhart's talk was on the effect of grading concrete products aggregates. It was illustrated with charts and its substance may be found in the book referred to.

Selling by the Ton vs. Guessing by the Yard

The paper by E. Earl Glass, the secretary of the Pacific Coast Sand and Gravel Association, has been already published in ROCK PRODUCTS, together with the ordinance making it obligatory to weigh all deliveries of sand and gravel in Los Angeles. (See ROCK PRODUCTS for November 28.) Hence the publication is omitted here. In closing, Mr. Glass said:

"So, to the business man in sand and gravel there is no question that the ton is the only unit that will permit a stability in his market.

"The conditions that governed in the first half of 1925 in Los Angeles and Southern California are pretty well corrected by the adoption of the ton in place of the yard. The yard led the producers to loose methods in all of their operations and as soon as they got on one basis of measuring it, selling their product, they began to stabilize other things that were out of line. We have only started on our career and we have already put over enough improvement to show us that organization is showing us the way out of a very chaotic condition.

Discussion

The discussion which followed did not take up the subject of the paper, as it was quite evident that the members were convinced that selling by the ton is the better method.

The matter of bulking of sand came into the discussion and J. L. Shiely of the J. L. Shiely Co., St. Paul, Minn., told how the matter was handled in his plants:

MR SHIELY: Last year we established a system of weighing our materials out for local delivery. We have a small electric stove that is operated by the pump man and each day he picks samples at intervals, samples of sand from our stock piles and bins. They are weighed, then placed in the electric drier and weighed after they are done. The city of St. Paul through its engineering department made tests and determined what the dry sand weighed—dry loose sand, not re-dried. Sand in St. Paul is sold by the yard on the basis of dry loose sand. We make the deduction for the moisture contained, depending on whether the load was gotten out of the rock pile or bins, and that is shown on the ticket. This may sound like a very difficult process, but it is very simple and the cost of installing scales and a scale house was paid for in the first two months of our operations last year.

The Association in California

MR. PRINCE: With reference to the California Association, early in the year 1924 I happened to be in Los Angeles and it was just about the time that the bad condition was beginning,—the bad competitive condition referred to by Mr. Glass—which was helped along by some of these practices which were unsound and which led to abuse of various kinds. From that time on conditions got worse; the industry was in a pretty bad state. After the Chicago convention last year we took it upon ourselves to send a missionary to California. We searched around for a person who had the time to give and secured Mr. V. O. Johnston to go out there and make every effort to show those producers the value of organization. He spent a month out there at the expense of the National Association. Later, some of the producers, who saw the value to be gained, got him to stay two months longer. Perhaps the time was not quite ripe yet, but I am convinced that the work done by him did bring to those producers the success they have enjoyed.

As a result of our activities the National Association now has some 25 or 27 members in Southern California and I think Mr. Glass has spoken correctly when he said the work done by the Association has been revolutionary in the practices in Southern California. It has been very satisfactory to the National Association to see this growth that has developed.

Business Prospects for 1926

THE prospects for business in 1926 were discovered by George E. MacIlwain, a Boston economist, who said in part:

"I think that I am somewhat more optimistic about the business outlook for 1926 than a good many of the men that talk and write about it. If anyone were to ask me what the sum total of business in the country in 1926 was going to be—if it would be as large or larger than it has been in 1925—I would be compelled to say that I did not know; I don't think anybody knows; at the same time, business has acquired a considerable momentum, and, while it is harder to start when you are stopped than it is to stop when you are started, I believe that the momentum that we have acquired and under which we are traveling at this time will carry us successfully through the first six months of 1926.

Mr. MacIlwain then quoted some of the "professional" forecasters — the business service bureaus. Their opinions of the prospects for 1926 are:

"ALEXANDER HAMILTON: 'A continuance of prosperity through the winter and into the spring.'

"BABSON: 'General business for the next four to six months expected to be splendid.'

"BANKERS ECONOMIC: 'General business should continue at the present rate at least through the first quarter and into the second.'

"HARVARD: 'Business cycle has advanced to such an extent that policy of conservatism should be maintained.'

"MOODY: 'Good business apparently ahead, continue through the first three months.'

"UNITED BUSINESS: 'The present momentum is sufficient to carry through the winter at approximately present levels.'"

Building Activity

Mr. MacIlwain said there were nine factors that affected business: Business activity, buying of the railroads, the automobile business, buying power of the farmer, the European situation, money rates, prices, manufactured goods on hand, and psychology. Concerning the first of these he said:

"I feel that what business is going to be in 1926 depends more upon what happens to the building trade than on any other one thing. Here is an industry which directly affects 35 or 40 other businesses.

We have had a wonderful year—three or four wonderful years—but 1925 is the most wonderful building year the country has ever seen. I gather that something like six and a quarter billions of building construction have been accomplished in the year 1925. The question is, is there going to be as much, more, or less in 1926 than in 1925? I think that I must have looked over 15 or 16, more or less authoritative forecasts of what business was going to be, some of which are evidently gotten up for propaganda purposes; others are more conservative, perhaps too conservative. I have in mind one which was put forth by people directly connected with the building industry to the effect that there might be 10% less

building in 1926 than in 1925; and there is a bank in New York which makes a forecast of 25% less in 1926 than in 1925.

"Now I am going to do a little guessing. I am going to suggest we follow a guess of 20% less building for 1926 than 1925. Let's take this 20% guess. The crucial question is, how is that amount of building going to be distributed? My own feeling is that building this year is going to start, and is starting, big, and for the first four or five months of the year the volume of building will compare favorably with 1925, possibly somewhat larger, and if there is a falling off in activity it will come in the latter months of the year."

Mr. MacIlwain here displayed a chart which showed building activity running to a high peak in May, continued through June and then a rapid drop to a low level for the remainder of the year. Speaking of the sand and gravel industry, he said:

Better Prospects for Sand and Gravel

"You are to be congratulated, no matter what the building activity of 1926 is, that the large portion of your work is concerned in road and bridge building, and the scale for this is larger than in 1925; and, even if there should be a drop in 1926, the steady increase that comes in road and bridge building will more than make up for any losses you might suffer from the other end of the line. If we have this drop that I am talking about we shall find ourselves in September with present contracts running out and with men that are employed now out of work and the material capacity now showing a tendency to pile up.

"Do you know what happened to the building trade employee situation in the last four years? Of bricklayers, since 1921 and up to and including this year, there has been an increase of 50% in number in the bricklayers' union. A similar increase has occurred in every trade.

"We have a material capacity on one side and a labor capacity on the other geared to the present rate of speed and when that speed drops off we are going to have some things happen that haven't happened in a long time. It is a matter of serious consideration.

The Buying of the Railroads—Equipment and Material

"The railroads have not bought very heavily in 1925. Some people fear they are not going to buy very heavily in 1926 because they began to buy in the fall of 1925 and because railroad stocks have been allowed to go up in the stock market in Wall street in the last six months. I think they are wrong. I think the railroads are going to buy heavily; perhaps not so heavily as in 1924, but more heavily than in 1925, and the business will have an added stimulus because of this added buying of the railroad; and I feel reasonably sure that through the plans for railroad legislation which are being made in Washington we shall have a point of view and a situation on the railroads which will stimulate buying by them in 1926."

Buying Power of the Farmer

Mr. MacIlwain would say nothing more of the automobile business than that it had grown to be the largest industry in the country and probably "had a trump up its sleeve" for 1926. Then he discussed the buying power of the former, saying:

"We are dealing yet with the 1925 crop here, and it is a fact that the total value of the crops is a little less than 1924, but that is not the whole answer to the problem. The fact is that there are some places where the farmers are very well off, just as there are some places where they have suffered tremendously. The wheat farmer's situation is more favorable than any time since 1920. The prices are higher, yes, but principally because the farmer did not sell his wheat until the high prices came in, and for the better part of that crop he is getting the price prevailing in the Chicago market. You have an exceedingly favorable position on the part of the farmer and, as a whole, the conditions of the farmer in 1926, as compared with 1925, are good."

Regarding the European situation, Mr. MacIlwain considered it much improved and said it would be a stimulus instead of the drag it had been. As to money rates, he thought they would be reasonable. Prices in general he considered to be stabilized for the coming year. Manufactured products had not been allowed to accumulate so much as to cause uneasiness. As to the psychology of the situation he thought intelligent business men had got over the war time notion that they could "walk on the sea," and that there would be a profit, but not much profit, for the man who kept his head and kept on the job. He then discussed the question of wages as follows:

"Wages Are Too High"

"I feel that wages are too high and my reason for feeling this way is the last report from the Bureau of Statistics in Washington covering this indicates a wage level of 137% higher than in 1913. Taking 100 as a level in 1913, the level now is 237. Meanwhile, cost of living is about 173%. That is, the costs of living increased about 73% and wage levels 137%. I am perfectly willing that every wage earner should get what he is worth and I want to see his wages go up as rapidly as his worthiness will permit, but the time has come when employers of labor should realize the situation we are getting into. The wages are so high that when the stuff is manufactured it cannot be sold at a profit. I do not think there should be any violent wage slashing, but I think we should lay the thing before them and in a co-operative effort try to get wage rates down once more in the United States."

Prices Are "Out of Line"

"Prices in most parts of the country are still somewhat out of line. What do I mean? I mean this: That the average price, as compared with pre-war conditions, is somewhere about 60% above pre-war prices. Some commodities are selling down where they were in 1913, some 60 or 70% above, and some 125 to 150% above pre-war levels. Prices are somewhat upset. I think there should be a trend for the fellow who is 100% above to work down to the pre-war level, and the fellow down here (60% below) to work up to a general level. I am very glad to understand from the officers of this association that the prices fall into a schedule that is strictly comparable with other prices.

Excess Producing Capacity

What appears to be a timely note of warning, if one grants that a drop in building activity is coming after May 1 was struck by Mr. MacIlwain when he said:

"There is no question but what in most of our industries we have a tendency to produce stuff that is in excess of consumption. We have this in the shoe business, where if all the shoe shops could run full time through three months they could shut down and let the people wear out the shoes the balance of the nine months. Any policy regarding producing capacity during 1926 ought to be governed directly by such knowledge as to what you are going to do with it after you have manufactured it. No one, who cannot see where their stuff is going, ought to increase their plant capacity.

* * * * * * *

"Now, the upshot of the whole thing is this: We are going to have good business for the first six months of 1926. We are almost sure to have good business during the entire year, and I think what the whole thing depends upon, more than anything else, is this: Upon the degree of confidence that business men have in 1926. If we can keep from upsetting the apple-cart we are going to be able to run business during 1926 much as we are doing now. But if some fellow rushes in, works as men worked in 1919, we are going to have our plants full of surplus materials. It is up to you, more than to anyone else; and upon your sagacity, your power to correctly gauge market conditions the things depends more than on anything else."

Discussion

Some discussion followed this paper. The effect of foreign exchange was asked to be explained and Mr. MacIlwain said the rate of exchange was being more and more controlled by the finances of the world being welded together. In answer to another question he said that he thought some co-operative system of marketing agricultural products would develop probably some international co-operative system.

Registration

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H. N. Battjes, *Grand Rapids Gravel Co., Grand Rapids, Mich.
C. M. Benson, *Union Rock Co., Long Beach, Cal.

*Association members.

J. C. Bible, *Montgomery Gravel Co., Montgomery, Ala.
Charles P. Biesanz, *Biesanz Stone Co., Winona, Minn.
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J. S. Burkett, Schofield-Burkett Const. Co., Macon, Ga.
H. P. Caldwell, *Ohio River Sand Co., Louisville, Ky.
Norman F. Callahan, M. A. Callahan Sand Co., Cleveland, Ohio.
John G. Carpenter, *Madison Sand & Gravel Corp., Hamilton, N. Y.
Bradley S. Carr, American Manganese Steel Co., Chicago, Ill.
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H. W. Christy, *St. Louis Material & Sup. Co., St. Louis, Mo.
Weston M. Carroll, *Niagara Sand Corp., Buffalo, N. Y.
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A. J. R. Curtis, Portland Cement Assn., Chicago, Ill.
Chas. E. Dalrymple, *Raritan River Sand Co., New Brunswick, N. J.
Alex W. Dann, *Keystone Sand & Supply Co., Pittsburgh, Penn.
H. S. Davison, *J. R. Davison & Bro., Pittsburgh, Penn.
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Edward Donnelly, *Ohio Gravel Ballast Co., Cincinnati, Ohio.
J. H. Duffy, *Ohio River Sand Co., Louisville, Ky.
Jas. N. Dugan, *J. N. Dugan Sand Co., Cincinnati, Ohio.
Geo. N. Dulin, Neil F. Ryan, Schenectady, N. Y.
Geo. M. Earnshaw, *Rock Products, Chicago, Ill.
Geo. H. Emanuel, *Pit and Quarry, Chicago, Ill.
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Wm. P. Fleming, Scofield Burkett Const. Co., Macon, Ga.
R. C. Fletcher, *Flint Crushed Gravel Co., Des Moines, Iowa.
Carl W. Fries, Marion Steam Shovel Co., Marion, Ohio.
G. M. Fries, Ohio Locomotive Crane Co., Birmingham, Ala.
A. E. Frosch, *East Liverpool Sand Co., East Liverpool, Ohio.
E. L. Gee, Perfect Classifier Co., Nashville, Tenn.
E. Earl Glass, *Pacific Coast Sand & Gravel Assn., Los Angeles, Cal.
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T. A. Hoeller, American Hoist & Derrick Co., St. Paul, Minn.
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L. L. Iddings, *Ala. Sand & Gravel Co., Montgomery, Ala.
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Stuart Mossom, Florida Geological Survey.
M. A. Neville, Western Indiana Gravel Co., Lafayette, Ind.
O. A. Nix, *J. R. Hime Sand & Gravel Co., Junction City, Ga.
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Eugene F. Olsen, Anchor Concrete Mach. Co., Adrian, Mich.
H. E. Schellberg, *Lyman Richey Sand & Gravel Co., Omaha, Neb.
H. V. Owens, *Boonville Sand Corp., Utica, N. Y.
Chester Padgett, *Dixie Sand & Gravel Co., Chattanooga, Tenn.
Frank W. Peck, *Muncie Sand Co., Kansas City, Mo.
C. H. Peters, W. S. Tyler Co., Cleveland, Ohio.
J. F. Poland, Brown Hoisting Mach. Co., Cleveland, Ohio.
F. E. Popplewell, *Ft. Worth Sand & Gravel Co., Fort Worth, Texas.
Robt. J. Potts, *Potts Moore Gravel Co., Waco, Texas.

*Association members.

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Stephen Stepanian, *Arrow Sand Co., Columbus, Ohio.
R. J. Stewart, *Pioneer Sand Co., St. Joseph, Mo.
E. B. Suter, Suter Material Co., Manchester, Ohio.
I. L. Suter, Suter Material Co., Manchester, Ohio.
E. Guy Sutton, *Neal Gravel Co., Mattoon, Ill.
G. F. Switzer, *Cincinnati Rubber Mfg. Co., Cincinnati, Ohio.
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Stanton Walker, National Sand & Gravel Assn., Washington, D. C.
W. M. Weigel, U. S. Bureau of Mines, Washington, D. C.
Frank M. Welch, *Greenville Gravel Co., Greenville, Ohio.
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Earl Zimmerman, *Ohio Gravel Ballast, Cincinnati, Ohio.
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Roger Wine, Portland Cement Assn., New Orleans, La.
C. H. Young, *Robbins, Young Co., Minneapolis, Minn.
Chas. H. Young, *Landers Morrison Christenson, Minneapolis, Minn.
H. J. Miller, H. J. Miller Lumber Co., Seattle, Wash.
D. F. Potter, B. F. Goodrich Rubber Co., Atlanta, Ga.
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Edwin Brooker, Commerce Counsel, Washington, D. C.
Mrs. Edwin Brooker, Washington, D. C.
Lillian Zimmerman, Cincinnati, Ohio.
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Mrs. C. M. Benson, Long Beach, Cal.
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Mrs. Earl Zimmerman, Cincinnati, Ohio.
Mrs. C. H. Young, Minneapolis, Minn.
Mrs. L. H. Chaney, Atlanta, Ga.

Good Roads Movement to Be Boosted in Ohio

THE National Road Show in Chicago has created a great deal of interest in more and better roads.

In connection with this movement, the Cleveland *Plain Dealer* is getting behind this and promoting a Good Roads Week for northern Ohio to begin in February, which is designed to stimulate interest among the people of this great community toward the advantages of good road construction.

Simultaneously with the inauguration of Good Roads Week in this territory, the *Plain Dealer* will publish a Good Roads supplement on or about February 14, containing news, photographs and advertising. This issue will be devoted exclusively to road construction, what it means to the automobile industry, to manufacturing, industry in general, and large and small communities.

They have received the co-operation of authorities who are to furnish them with news, and they believe this will be one of the most interesting sections that has ever been published by the *Plain Dealer*. An excellent schedule of news stories on road making, road types, etc., written by authorities on the subjects, has been arranged and will be printed from time to time.

Road Construction Records

RECORD-BREAKING road construction mileages are not so commonly told of as they were a few years ago. We take even the vast sum of our total road building operations a little perfunctorily. Individual accomplishments of magnitude are too common to be startling. Yet there is value in rehearsing the records occasionally. At the end of this year there will be half a million miles of surfaced highways in the United States. This is the latest estimate of the Bureau of Public Roads. The permanent grade, ready for surfacing, has been completed on an additional quarter of a million miles. Road surfacing is now proceeding at the rate of 30,000 miles a year. These figures include all roads, not merely those that receive federal aid. They are stupendous figures by any manner of counting. The records of individual states are equally amazing. Pennsylvania this year has added a thousand miles of paved roads to its state system. It now has 5700 miles of such roads. Illinois built in 1923, 1028 miles, in 1924, 1200 miles, and in 1925, 870 miles of concrete roads, and about 100 miles of other surfacing, and no county road work is counted. Broken down into its elements of materials, labor, equipment, engineering direction and contracting management, a thousand-mile annual paved road program presents an industrial development which is remarkable even among modern great creations of business. In this aspect record mileages of road construction are still significant and deserve being announced.—*Engineering News-Record.*

Proceedings of the Ninth Convention of the National Crushed Stone Association

A General Summary and Digest of the Subjects Discussed and the Work Accomplished

THIS is not published as a complete report of the convention. It is a collection and summary of what seems to the editors to be the most important parts of the proceedings, arranged under the following general heads, so that the reader may readily select such parts as have the most interest to him without wading through the whole.

1. ***RESEARCH—as viewed by the president; the head of the engineering bureau, members and guests.***
2. ***MARKETS—as viewed by prominent engineer guests and members; under the following sub-headings: (a) Highways; (b) Ballast; (c) Agricultural limestone; (d) Specialties.***
3. ***PREPARATION OF CRUSHED STONE FOR MARKETS—as viewed by engineer guests and members.***
4. ***SALESMANSHIP—Being pointers by engineer users and salesmen themselves.***
5. ***OPERATING POINTERS.***
6. ***TRANSPORTATION AND FREIGHT RATES.***
7. ***THE ACCOMPLISHMENTS OF THE ASSOCIATION.***

The editors expect to draw on much of the other parts of the proceedings for text and inspiration in the issues to come.—The Editors.

THE primary object of an industrial convention is education and the enlightenment of those who are privileged to attend. But most conventions consist of a heterogeneous collection of papers and discussions on a variety of subjects with little or no attempt at system or order and no attempt whatsoever to avoid unnecessary repetition and commonplace generalities. The result is that one who conscientiously attends sits through seven or eight hours a day in a semi-lethargic condition, perhaps able now and then to pick out a kernel of wisdom, but wholly unable to generalize the result of four days' deliberations. As one returning delegate aptly put it: "Now we are going home to wonder what it was all about."

So in our report of the National Crushed Stone Association proceedings at the Montreal convention we are departing from the time-honored chronological method of treatment, and endeavoring to summarize and digest the four-days' papers and discussions under the seven general heads in the accompanying outline helping ourselves to paragraphs and sentences in various papers and discussions, irrespective of their chronological order and of the subject that may have been given or taken by the author or speaker. We trust we have handled the text and the context in such a way as to be fair to the authors, and we trust they will overlook our failure to give their remarks at full length in our attempt to make the convention proceedings easier of absorption by the busy reader, than they would have been by keeping all that any one author or speaker may have said intact.

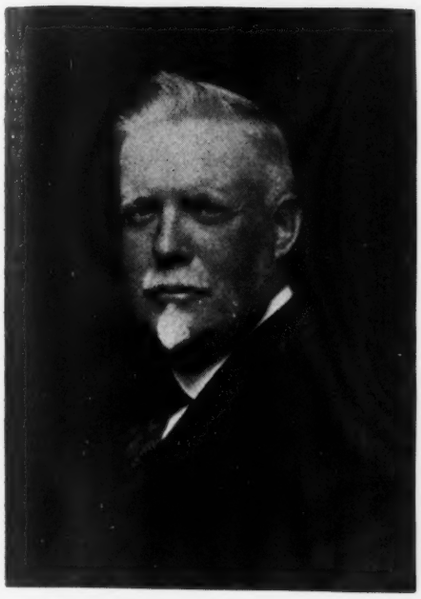
Otho M. Graves, President, National Crushed Stone Association

Research

The big outstanding development of the National Crushed Stone Association in 1925 was the establishment of an engineering or research bureau under A. T. Goldbeck, for many years one of the most noted engineers with the United States Bureau of Public Roads at Washington, D. C. To make this possible various public-spirited members and groups of members have underwritten the expenses of the association for a period of years, many members have voluntarily doubled their membership dues and many new members have joined to assist and share in the work. For this purpose the headquarters of the association were moved from Columbus, Ohio, to Washington, D. C.

Contacts with Other Engineering and Research Organizations

President Graves summarized



A. R. Wilson, Vice-President

the contacts already established as follows:

We are members of the American Society for Testing Materials. We have personal representation on the following committees: Committee C-9, Concrete Aggregates; Sub-Committee 5 of that committee, which has more specifically to do with aggregates entering into road construction; Committee E-1, Methods of Test; Committee D-4, Road Improvements.

We have personal representation, through Mr. Goldbeck, in the American Association of State Highway Officials, with representation on the Committee on Structural Design of Highways, of which Mr. Goldbeck was until recently chairman.

We have membership in the Association of Highway Officials of the North Atlantic States, and personal representations on the following committees:

Committee on Road Materials on the Federal Specifications Board;

Structural Design Committee of the National Highway Research Board;

Research Committee, American Society of Civil Engineers;

Joint Committee on Concrete and Reinforced Concrete appointed by the A. S. T. M.

We also have personal representation on the American Engineering Standards Committee.

The Object of Research

PRESIDENT GRAVES:

The only way I believe this association or this industry can grow and prosper is by forgetting the desire to prosper, by remembering only there is a distinct obligation on every producer of crushed stone to serve the market as he finds it, or as he makes it, in the most efficient and effective manner.

G. J. Whelan, Vice-President

It is true, of course, and it is not improper to recognize it, that as a by-product of such effort prosperity always follows, but it must come as a by-product. Every man and every company should endeavor sincerely to examine his or its own conscience in order that he or it may better serve those world interests, as may be required, in an effort to get into the scheme of eternal existence as it is before us. If we do not make that effort the future is not particularly roseate. Now, I think this association is doing exactly that thing.

In referring to the establishment of the bureau of engineering I did so only to show you that so far as I was concerned I was not talking idly a year ago, nor am I now, in saying that as I see it the bureau of engineering must seek to serve the users of our material, and not seek to serve us. I believe as firmly as I believe I am standing on this platform that if the bureau does exactly this, efficiently, effectively and sympathetically, and devotes itself to serving the interests of the users of our product, it could not in any conceivable way better serve our own interests.

Thomas McCroskey, Vice-President

If there is any doubt in the mind of anyone that we should start a propaganda and throw the slogan across the country that "stone is best by every test" regardless of what other interests may be, now is the time for us to discuss it. I do not believe in those suppressed thoughts or suppressed desires: It is by talking we get ideas. No man objects to another differing from him frankly and openly. I think you are in sympathy with the idea, but I can only tell your opinion as Mr. Goldbeck, the board of directors and I get the reaction from it.

I do not want to be misunderstood. I

W. R. Sanborn, Vice-President

C. M. Doolittle, Vice-President

believe the association should serve the industry, and I think we all feel the same in this respect. We want our industry to prosper, because it is natural and human. We are not going to be so idealistic that we will not keep both feet on the ground. At the same time I believe the best way of serving ourselves is to serve the user of our material. The motive for what we do as to serving the user of our material should not be that because by so doing we ourselves will prosper, but because it is the right thing to do. It is right to serve the user of our product, and if we can do it in the clean conscientious way through our bureau, I think good which will always follow in the train of the right line of action will unquestionably accrue to us.

Future Work for Bureau

Regarding the future of the association's research work, PRESIDENT GRAVES continued:

The bureau of engineering is susceptible of greater development than is yet planned. I think it is always helpful to dream dreams and to hold ideals, even if they do not always materialize, and I would like to see the association holding certain ideals and looking forward to practical development, even if we do not ever get there.

I am particularly interested in wishing that sometime in the not very distant future it will be possible for the bureau of engineering to conduct itself certain preliminary tests, not with the thought particularly that we are going to test various matters and put them out as our findings, because I know the objection to that fully as well as you do. We have, however, in Mr. Goldbeck a man who has all his life concerned himself with matters appertaining to testing material, and who is recognized as an authority on the subject. Thoughts and queries occur to his mind all the time, and possibly he wonders a bit, as to what would happen if you did this, or did that, or did something else. I think he should be equipped to start certain preliminary investigations. I refer particularly, of course, to road design and the testing of materials as they enter into road construction. He should have sufficient equipment and facility to start certain investigations, and if he finds there is anything in the matter investigated he could go to an established testing society or to any of the boards at Washington and say: "I have gone thus far, and these are my findings. Are they not of sufficient interest to you to take the matter up and carry it further?" I think it is well worth our while seriously considering the proposition.

If it is not to Mr. Goldbeck's interest, and it is not to our interest, to remove him from a field in which he is a recognized master, and say to him: "You must not touch testing." I am not making a plea for Mr. Goldbeck, but I am making a plea for the association. I think certain facilities should be eventually placed at his disposal by which he can start preliminary tests preparatory to carrying them to completion before other boards.

This, of course, contemplates a larger budget than we now have, but I think it is entirely susceptible of practical accomplishment.

Mr. Goldbeck Outlines His Views

In a broad general way research in the crushed stone industry holds potential benefits in certain well marked directions. I realize that your ultimate criterion of success will be the development of your business in the future as contrasted with the past. Primarily you would like to maintain your growth in a manner that will stand favorable comparison with the producers of other aggregates and your bureau of engineering fully realizes that its efforts must be directed to that end. If this were the only end, however, if you believed that you alone should receive benefit from the work of your bureau, the venture would be foredoomed to failure or to only partial success, just as is all purely selfish enterprise. I have faith in a larger and more unselfish viewpoint which you, too, must have had when you originally conceived of the bureau of engineering.

Your bureau holds an attitude of helpfulness not only to the industry, but also to all users of your product. In generous measure we stand ready to aid the using public in any solution of their problems pertaining to stone, and to assist in any practicable manner in the development of better design, better standards of construction and better specifications. These are things which we, as a national body, should contribute to the general good, for in so doing we maintain our respect as a nationally useful organization. Moreover, general helpfulness cannot but redound to our benefit. Friendliness begets friends.

But you wish to know specifically how we think we might be able to function to good advantage. How can engineering research help you and in what channels should that research be directed? Generally speaking you will be assisted, (1) if ways can be discovered to produce stone at less cost; (2) if your waste products might all be utilized; (3) by improvement in your product; (4) by improving the design of structures utilizing crushed stone; (5) by supplying the facts which will show the advantages possessed by stone in various types of construction; (6) by service to crushed stone users. Let us consider these six phases in some detail.

I. The More Economical Production of Stone

A perusal of cost of production records shows a wide range of figures whose divergence is partially due to unavoidable circumstances such as character of rock, location and character of quarry, and many other factors with which you are far more familiar than am I. But, nevertheless, when I see figures for individual cost items varying widely in plants operating with the same character of rock, and with about the same production, it seems quite probable that investigation directed toward cost reduction holds considerable promise. The bureau of engineering can help in this work by acting as a central agency for the instigation of lines of research within the industry at certain plants which seem to lend themselves to the particular problem in hand and which might be benefited thereby. For instance, there seems to be room for further work on the size and location of blast holes as governed by the character of rock and other influences, boulder breaking, loading and delivery, crushing and screening, and no doubt other items. All of these vary widely at present and possibly organized research will show the way to a general reduction in these costs.

Screen Standardization

Another item which the bureau of engineering should handle is that of screen standardization. Many of you are handicapped by the necessity for supplying more sizes of stone than are actually necessary for the successful performance of construction work. Adjacent states which you are serving often have specifications which vary just enough to make you keep on hand an unnecessarily wide variety of screens. A simplification of sizes and the bringing into being of a national nomenclature for those various sizes would do much toward simplifying the industry and would eliminate confusion. Engineer, contractor, and producer would then all talk of stone sizes in the same terms throughout the country. A start has been made in this direction by the road materials committee of the American Society for Testing Materials. We can help them by having their report given proper consideration by one of our technical committees, or by a special committee appointed for that purpose. After our criticisms have been received by the A. S. T. M., their present tentative standard for commercial sizes of stone will then be proposed as a standard of the Society. The next step might be its proposal to the American Engineering Standards Committee as a national standard. The matter might also be handled through Secretary Hoover's Division of Simplified Practice.

From what I am able to judge of your present organization, I am convinced that you would do well to appoint more sub-committees to study particular subjects within the industry. The bureau of engineering should be active on those committees and, in fact, one of its functions should be to help the committees and keep them at work. We certainly wish to reduce costs of production. Let us start some investigations along well-laid lines, to find out how this can be accomplished.

II. Utilization of Waste Products; (a) Stone Screenings

Many of you have on hand and are still accumulating large quantities of material now without a sufficient market. Stone screenings are a burden and their disposal at a profit would decrease the cost of production as a whole. One of the problems, then, is to fully present the various means by which this material might be used successfully. Some of you have already established concrete products plants for this purpose, others have been successful in disposing of stone screenings for use as a fine aggregate in various forms of concrete construction, used alone or in combination with sand, for use in roofing products and in granolithic floors or sidewalks.

For developing the use of screenings as a fine aggregate in concrete research holds considerable promise. Researches have already been performed showing that screenings might be used for concrete construction provided they are made from durable rock and are mixed in those proportions which will result in a dense strong concrete. One of the secrets of durable concrete is density with strength, and well-graded fine aggregate is a very important factor in the attainment of high density. The very best results will be obtained from screenings when they are graded in much the same manner as a good grade of concrete sand. As a rule commercial stone screenings are characterized by a large proportion of coarse particles and a large amount of dust with a lack of intermediate particles. A much higher degree of workabilty in concrete containing screenings would be secured if the screenings were reground and screened to meet concrete sand specifications. A very highly

satisfactory product for all kinds of concrete construction would then result. Much investigation should be carried out along this line and the commercial possibility of the preparation of properly graded screenings should be looked into by those plants so located as to make a processed screenings market profitable. The work of the bureau of engineering will be to get the necessary research accomplished to demonstrate the possibilities of stone screenings.

One very important development in connection with the use of screenings has come out of the research work on subgrades of the United States Bureau of Public Roads. Thus, subgrade research shows that roads are very greatly affected by the type of soil upon which they are constructed. In general, those soils which are highly plastic, such as clays, are very apt to give trouble for they take up and hold considerable quantities of water both from below by capillarity and from above. They then become soft and swell in volume considerably and give very poor support to the road. When they dry out they shrink unequally with a resulting unequal support, particularly for the rigid type of road. The more granular soils, on the other hand, give very good results for they drain easily and are not particularly affected by moisture.

When roads are built on the bad type of soil special care must be used in their design and construction and one of the remedies which seems to give the very best promise is the use of a layer of fine granular material as a "blanket" course between the bad subgrade and the road surfacing normally used. Stone screenings containing the dust of fracture comply with this description of fine, granular material. The use of a layer of granulated material under concrete roads has worked out to very good advantage in several instances, some of which are mentioned in the September, 1925, issue of *Public Roads*, in an article entitled, "The Present Status of Subgrade Studies," reported by A. C. Ross. The usefulness of a blanket layer under concrete roads is perhaps not as apparent as under the macadam type. The so-called "frost-boil" in macadam roads laid on poor subgrade material is a familiar phenomenon in our northern climates and occurs during periods of thawing after severe freezing. At this time the subgrade is saturated with water and consequently is very soft. Wheel loads which of necessity are transmitted to the subgrade create pressure intensities high enough to cause plastic flow of the soft subgrade and the pavement is depressed under the wheel and elevated between the wheels by the upward pressure of the underlying wet plastic clay. Eventually the clay breaks through the surfacing material and more and more mud is forced to the surface with each passing vehicle. The phenomenon of "mud-pumping" occurs upward through macadam just as it occurs up through ballast in a railroad track.

A blanket or "shut-off layer" of fine granular material is undoubtedly of considerable value under macadam laid in cold climates on a comparatively poor subgrade. In the first place, by virtue of the increased depth of the pavement, the pressure on the subgrade is decreased in intensity and, moreover, the pavement crust is strengthened, first because of its increased thickness, but most important of all because the fine granular layer prevents the intrusion of mud up into the voids in the pavement. Thus, the full effective thickness of the pavement is maintained. This idea of the use of a layer of granular materials of the nature of fine stone screenings is very much worth while developing, and much research work can be started throughout the country that will, without question, lead to better macadam construction than we have had in the past. It is the purpose of your bureau of engineering to very thoroughly investigate the possibility of this construction, for it means much to all road-constructing agencies and to all road users, while to the producers of stone its significance is quite apparent.

There is considerable discussion among highway engineers as to the development of the "secondary" type of road. Although large mileages still remain to be constructed the primary routs are being rapidly completed, leaving large mileages of lower type roads for secondary routes to be built in the immediate future. Stone can be used to very good advantage in this secondary construction. For instance, stone screenings might well be employed as a surfacing material on graded and drained earth roads, maintained by dragging and by the application of more screenings as required. In this way a very stable surfacing may be built up which will be in excellent condition to receive a higher type of construction when demanded by traffic. Instances of this procedure are available and similar experiments could be carried out to very good advantage in a large number of states. Such experiments should be encouraged by your bureau of engineering.

(b) Stone Dust

Stone dust is a waste product that holds strong marketing possibilities. Already some of you have installed vacuum recovering equipment which not only makes your plants more livable and your product free from objectionable dust, but in addition separates and makes available a large amount of finely divided stone dust which should have usefulness in a number of industries. Thus, as a filler in bituminous cements for asphalt pavements and in bituminous expansion-joint material, as a paint filler, as a fine abrasive and for the dusting of mines for the prevention of explosions, stone dust has usefulness and without question many other uses remain to be discovered. Research by the bureau along this line should be well worth a strong effort.

III. Improvement in Crushed Stone

At first thought one might conclude that there is little to be done to improve a material such as stone which is nature's product and which surely is unalterable in its physical properties. Such, however, is far from the case, for the minute stone is crushed its size and cleanliness become as important as its physical characteristics, and along these lines investigations are needed. An industry should not be content merely to supply the sizes its customers desire but it should be able to advise with them as to what sizes are best for a given purpose.

What sizes are really best for concrete construction of all kinds, for macadam and for bituminous roads?

What effect has the character of stone, whether hard or soft, on the sizes which should be used?

What is the best and most practicable way to supply the consumer with stone really graded in the way he wants it?

How can segregation of sizes be overcome?

When should washing of stone be resorted to?

These are sample questions which can be answered only in part at present but which will need some real investigation to answer in a satisfactory and convincing way.

It is proposed that the bureau of engineering will conduct researches on these questions or have them conducted in the manner most likely to produce results. The producers themselves can be of great assistance by engaging in cooperative tests along some of the above lines at the several points, and an outline of these tests will be suggested at a future date. The users of stone can likewise help on researches in the field to their very great advantage, for these investigations are aimed primarily at helping to get better results in the final use of the material. If the user is benefited to the extent of securing stone constantly in conformity with his desires, it is obvious the stone producer likewise will reap a considerable measure of that benefit.

Much attention has already been devoted by your bureau to the problem of coarse aggregates in concrete roads and a study has been made of the influence the size of aggregate has on the cost of the concrete. As a result of this study researches are now being strongly urged in several state highway departments to determine the best grading of stone for the production of the strongest, the most workable and most economical concrete. The results of this research should make for more economical stone concrete and therefore for more equitable competition with other aggregates.

At this point I want to say very frankly and very earnestly that you producers have not always cooperated with the user of your product in supplying him with just the size and just the grading demanded by the specifications, and my general impression received from a number of sources is that you have suffered as a result. Stone for a given purpose cannot be skimped in certain sizes just because there happens to be a big demand for these sizes for other types of construction. You might gain temporarily thereby but in the long run you and the industry most emphatically will suffer. Happily this point is now better recognized but it needs your utmost and constant attention.

IV. The Discovery of Means for Improving Construction— Utilizing Stone

Improvements in the qualities of those types of construction in which crushed stone is used would be of benefit to the user and by reflection to the producer. Much research has been performed in the past few years on concrete roads looking particularly to improvements in their design to suit present day heavy-load conditions. The possibilities of further research along that line are now more limited by virtue of the valuable facts which have already been brought to light. Nevertheless, much remains to be discovered as to the influence of various factors, including the aggregate, on the durability and life of the concrete road. The field of research in the development of other types of roads involving the use of stone remains practically untouched and in view of the probable development of cheaper road types for the great mileage of secondary routes, no doubt this field will be actively occupied in the future.

The macadam road has not been developed in design to any extent nor have the principles of construction been changed. It is illogical to require thick edges for concrete roads and be satisfied with the unaltered old design for the macadam types. Much useful research is needed to show the most advantageous cross-section design for the "flexible" road, just as it was necessary for the

concrete type. If research will improve the flexibile types and show their limitations, they will be rendered better fitted for carrying heavy traffic and moreover will then be brought into more active competition with types which now alone are considered suitable. Your bureau hopes to be able to suggest schemes of improvement logical enough to warrant their trial and investigation by highway constructing agencies. The use of a "blanket course" is right now a fit subject for thorough investigation, for it has already given good results and promises well. The use of a layer of crusher-run stone containing dust should likewise be generally helpful as a foundation layer. Means for increasing the lateral strength of macadam at the edges of the road should also be given a thorough trial and researches along these lines will be inaugurated if possible. Any improvement in design of any road type making for more efficient service behavior or decreased maintenance expense inevitably must lead to the increased use of that type.

A study of the effect of size and grading of stone in macadam roads looking to their increased load-carrying ability or to the maintenance of their original riding qualities is another research worth undertaking.

Still another field which is practically untouched is the maintenance of old concrete roads which have served their usefulness. What is the most economical procedure, a second story of concrete, a layer of bituminous concrete or bituminous macadam?

A comprehensive series of tests of this kind, well laid out and in considerable detail, should be welcomed by those states and counties now confronted with concrete maintenance problems. An investigation should be conducted on the proper size of cover material for use with bituminous surface treatments on macadam on other roads. What size stone is best for given grades of bitumens? What is the best size for use in the bituminous treatment of the earth type road of the south? Stimulation of research along these lines and the publication of papers bearing on the results surely can help promote the proper and more successful use of stone. But enough has been said to indicate how your bureau might stimulate research which will lead to better design and construction of all types of roads in which stone is used.

V. Supplying Facts Showing the Advantages of Stone in Road Construction

It has already been announced that your bureau of engineering does not propose to enter upon any campaign of attack on competing aggregates. That will not be one of its functions and any such campaign within the crushed stone industry should be discouraged by the National Crushed Stone Association. For yours is a high grade and important industry which you have dignified and which you hope to further develop by identifying it with scientific research. Your development efforts will be strengthened by a strict adherence to business principles demanded by high grade industry. Furthermore, I know from experience how distasteful attacks on competing materials are to those whom they are expected to impress. I need not tell you how much better salesmanship it is to advance the merits of your own material than to decry your competitor's material. I do not mean to imply that you should not be fully informed as to the advantages and disadvantages of all competing aggregates, for most emphatically you should be so informed in order to better present the merits of crushed stone.

There is much to be studied as to the relative characteristics of different aggregates. Some researches have already been completed and the results will be collected. Other researches will soon be published and still others are now under way. The facts from these researches will be made available to you. But there is still a great untouched field of research which might be undertaken on the relative characteristics of the various aggregates. As you well know most comparisons of concrete to determine the relative superiority of different aggregates have been made on the basis of the crushing strength of concrete, but has it ever occurred to you that the failure of a concrete structure through crushing is an exceedingly rare occurrence? Concrete roads having proper provision for expansion do not fail because of high compressive stresses and, moreover, the forces which do act on them act not once but thousands of times.

Concrete roads are subjected to alternations of compression and tension with every passage of a motor vehicle; they are expanded and contracted by temperature every day and by changes in moisture content and in addition are subjected to freezing and thawing. Cross-bending stress as well as direct tension are produced perhaps thousands of times daily and invariably the cracks that form in the surface are due to tensile stresses rather than to compression. We should accept compression tests merely as a tentative measure of the quality of concrete for road construction and in the meantime try to discover what are the effects of these oft-repeated stresses on concrete roads of different aggregates and having different characteristics.

Thus, I have in mind the necessity for making tests, such as are not commonly made, on concrete containing different aggregates, including repeated static loads, repeated impacts, alternate freezing and thawing, alternate temperature changes, expansion and contraction, accelerated soundness tests, cross-bending and direct tension. Moreover, coupled with all this a complete survey should be made of the service behavior of concrete roads having different aggregates. You can now see that the possibilities of research for demonstrating the differences which exist in aggregates are very wide. The main difficulty is in getting the researches performed and many times of late I have wished for a well-equipped laboratory. However, these tests are being outlined in detail and their performance will be urged by those having proper facilities and sufficient interest to do the work. The government, states and university laboratories no doubt will undertake some of these problems in time and results will become available from different sources. The facilities offered by the Highway Research Board of the National Research Council for making field surveys must be kept in mind and perhaps you will be in a position financially to take advantage of these facilities at a later date. A survey conducted by this agency would be given general recognition throughout the country.

As the research facts become available it will be the duty of your bureau of engineering to present these facts in such a manner that they will be easily understood. Likewise they should form the basis for technical papers. Such papers will be published in the *Crushed Stone Journal,* and in separate form by the Association. Papers will also be presented before technical bodies from time to time and will be published in the technical press. Facts which have become established eventually are incorporated in specifications and it will be my duty to present such facts before the important specification-writing bodies.

VI. Other Service to Crushed Stone Producers

Perhaps enough has been said to give you some idea of the research work which remains to be performed to help the industry. You also probably have a better idea of how the bureau of engineering can stimulate the needed research and finally how it is proposed to make the established facts useful to the industry. There are other ways in which you can be assisted. The publication of standards of various sorts covering specifications, design, and construction of roads involving stone will serve to keep stone actively before the user. Proper standards which can be embodied in local specifications surely will serve to engender a more favorable attitude toward your product and your salesman should be helped correspondingly.

The limited publication and analysis of helpful statistics should also be undertaken. As you can well realize there is a tremendous amount of detail work to be accomplished. Much of it deals with the obtaining of facts through research. Research requires painstaking work and some of you will get impatient for results. You would like to have them immediately. It is possible time will disclose the necessity for speeding up some of the detail work through the employment of assistants and it seems not at all improbable that time will also demonstrate the desirability of the industry's performing research work in a laboratory of its own or in field laboratories established for that purpose. The main consideration right now is that your bureau proceed along lines that are sound and direct. You are building for the future and the foundation is most important; for the super-structure must be well supported in years to come. A number of you have valuable ideas that will contribute to the usefulness of your bureau of engineering and your director most certainly will welcome them.

Views of Members on Research

W. SCOTT EAMES, vice-president and general manager of the New Haven Trap Rock Co., New Haven, Conn., said:

Great credit should be given to the president of our National Crushed Stone Association for establishing the bureau of engineering. To my mind this is one of the greatest achievements since the National Crushed Stone Association was organized. No one is more familiar than I am with the tremendous amount of work Mr. Graves has done in the past year to bring about this result. When it became known that we were to establish the research bureau and had secured Mr. Goldbeck, New England stone producers and also engineers who have charge of all public works were greatly interested, and you will find here in this audience a large number from New England who would not have come and have taken an interest if we had not secured a man such as Mr. Goldbeck.

* * *

Since taking up his duties as director of the research bureau of the National Crushed Stone Association, there has been widespread comment by state and city officials, by other research bureaus and by engineers all over the country, all of whom have expressed utmost praise and satisfaction, when it was known that the bureau was to be headed by

Mr. Goldbeck.

Mr. Goldbeck is a true scientist, and one who confines himself to truth, and to truth only. He may be a part of the Crushed Stone Association, but he cannot be influenced by that, or any other association.

That, gentlemen, is the standard we want to set for this research bureau.

Personally, I want to congratulate Mr. Graves (who was an old friend of Mr. Goldbeck) for his wisdom in selecting Mr. Goldbeck for this office and for his ability to secure him, which meant for Mr. Goldbeck, leaving the work which had become so dear to him.

Mr. Graves has done the Crushed Stone Association a great service, and through it, the progress of highway work throughout the national will be benefited.

* * *

We have founded this research bureau for the sake of finding out how stone can best serve for the good of the public.

As this is found out, our sales managers must sell this information, and it should be the object and pride of every quarry to furnish a material graded and prepared to suit best that customer's needs.

P. B. REINHOLD, of Reinhold & Co., Pittsburgh, Penn., said:

We in Western Pennsylvania have had very interesting meetings in connection with the research bureau ending with Mr. Goldbeck's and Mr. Boyd's visit in December. In view of the keen competition of slag and gravel we anticipate Mr. Goldbeck will be in a position to render invaluable service, and we have no doubt as to his ability to solve our problems when they are reasonable.

Certainly in our territory Mr. Goldbeck can be of invaluable assistance in showing us how to help the users of our material. As it is at the present time (and I do not make these remarks in any disparaging sense) many contractors using limestone simply take the material, put it in a concrete mixer, and make a guess as to how it should be used, and quite often taking the chance of getting by under specifications which are not sufficiently rigid. We hope and believe that the sentiment that we are at all times trying to help the users, will help ourselves.

N. S. GREENFELDER, of the Hercules Powder Co., associate member:

We in the Manufacturers Division believe that the association has taken a great forward step in establishing an engineering bureau headed by a man with the ability and reputation possessed by Mr. Goldbeck.

We appreciate the opportunity to support you in this move, and we propose to continue to work shoulder to shoulder with you in attacking the problems which confront your industry.

JOHN RICE, president of the General Crushed Stone Co., Easton, Penn.:

I think the policy, as outlined by Mr. Goldbeck, is one of exceeding interest. I certainly approve of the conservative thought that he expresses in connection with the development of this bureau.

If this bureau does not perform a real service to the highway departments, and the users of crushed stone generally, it will accomplish a very small purpose.

We cannot expect technical men to go into a mere propaganda to promote our own particular industry, unless the industry itself deserves it. We can only be developed by research, and I think it is of exceeding interest to show the real, material things which Mr. Goldbeck suggests.

Those are, really, more than we expected, but I want to caution everybody—perhaps, having thought more about it—we must not expect definite, practical material results in dollars and cents inside of a number of years, but I want to bespeak your encouraging support for this bureau until it demonstrates that it is able to succeed.

E. J. KRAUSE, president of the Columbia Quarry Co., St. Louis, Mo.:

We, in Illinois, are facing a really serious problem. Every producer of crushed stone is in thorough accord with the establishing of this bureau, and will heartily support it.

At the time President Graves proposed this bureau, we had already discussed the engineering problem we were concerned with, and we had appointed an engineering committee in Illinois, and we were very glad to see this work undertaken on a much broader and more progressive scale.

The producers don't expect material results at once, and we are prepared to go on and assist you and help support the movement.

F. W. SCHMIDT, Morristown, N. J.:

Mr. Goldbeck has explained the situation in such a clear and lucid manner that it is up to us to support the program as laid down.

If we want results faster, we have got to dig deeper. There is so much information that we can get if we have the time and facilities to go after it, and it is up to us to pass on to Mr. Goldbeck such information as we can get, as he has asked for, so as to enable that information to be spread amongst us at the earliest possible moment.

I am sure that we have the right man, and we should all support him to the end.

C. L. BLAKESLEE, treasurer of the New Haven Trap Rock Co., and president of the Connecticut Quarries Co., New Haven, Conn.:

I think you are on the right track, and I am very happy to be here and record my expression of that fact to you. I believe there is a great field in the crushed stone industry, and I believe the producers of that product have done the right thing in securing Mr. Goldbeck. I know you are on the way to even better things in the future.

Comments on Research by Non-Members

E. J. MEHREN, vice-president of the McGraw-Hill Publishing Co., and former editor of *Engineering News-Record*, New York City, said:

It does not require any great deal of thought to give one's very hearty approval to a move such as you have made, in having a thorough research made of the uses of crushed stone.

It must be truly inspiring to you to get a scientific analysis, such as has been presented here; it shows a type of thought that augurs very well for the results which you may expect in the future.

What you are doing is consistent with the whole body of industry today. We are no longer satisfied with the "rule of thumb" methods. We can get larger profits by finding out facts that lie in the background, and this will result in better service to your customers.

As I say, it is not at all difficult to give a very hearty endorsement to what you are doing today. The electrical industry is built up on the laboratory, and if we were to take away the laboratory the industry would slow up. If this is true of that industry, why should it not be true of the industry in which you are concerned. The fruitfulness of the results obtained in other industries warrants the faith which you have.

Pardon me if I cannot give any more coherent remarks, but I can bear testimony to the soundness of that which you have done, and most heartily congratulate you on the step you have taken.

HOWARD E. SMITH, division engineer, New York State, Department of Public Works:

In the first place I was greatly impressed by the tone and character of your president's address yesterday morning, in which he stressed the point that the high ideal and purpose of the organization was to make it of the greatest benefit to the users. Many organizations have been created in the past, some of which have survived and some of which have not. I think an organization which is based upon the ideal and purpose of making itself of greater service to the users of the product is the one which must survive, and with this ideal maintained in the future I predict the success of your association.

Lack of knowledge as to the behavior of material entering into construction has caused the users vast sums of money, and any effort that can be put forward by your association to give the users of your product more information as to the behavior of the ingredient in which you are interested, as it forms part of the construction, will be of great service to the public.

As one of the division engineers of the state highway department of New York, I am interested primarily, of course, in the use of aggregate in pavement construction, and it naturally comes to my mind what is the relation of a division engineer to a great organization of this sort. Certainly it is not one of antagonism. I think with the purposes outlined by your president our relation with you as an organization must be one of friendly co-operation. We certainly are seeking towards the same end—to find out more about those materials which go into construction, and to make the moneys expended naturally go the farthest.

W. G. BLAUM, testing engineer, New York State Highway Department, suggested two subjects for crushed stone research: (1) Present methods of testing stone were designed for the test of stone for macadam roads; these tests are not suitable for developing facts about stone for present types of road; tests should be developed to show resistance to freezing and weathering. (2) A vast difference in sizes of stone was now required to meet various specifications; research could be directed to determine a definite ideal sizing.

Markets for Stone

A summary of market and business conditions in the various localities represented by members of the board of directors was published in Rock Products, January 23, page

65. It was obvious that highway construction accounted for the largest part of 1925 tonnage. Various papers and discussions referred to the market for highway stone. These we have attempted to summarize in what follows:

What One State Is Doing

A good example of what one progressive state is doing in the way of highway building was described by P. B. REINHOLD of Pittsburgh, Penn., as follows:

The department of highways of Pennsylvania constructed about 1100 miles of highway during the year. This mileage includes concrete, waterbound and bituminous macadams as well as reconstruction of deteriorated highways. Of this total, approximately 758 miles were of concrete construction. It is interesting also to know that of the entire total mileage of new construction, about 99% was of the concrete type. As previously stated there was marketed approximately 800,000 tons of road stone in western Pennsylvania, covering highway jobs supervised by the Pennsylvania department of highways, as against approximately 30,000 tons of slag used in the same type of construction. The 1925 program has indicated 223 miles more than was ever constructed by the Pennsylvania department of highways in a single year. We find that from 1911 to 1923, $196,000,000 was spent on state highway construction. However, of this total, about $150,000,000 was spent from 1919 to 1923. It is estimated that the total expenditures from January 1, 1923, to January 1, 1927, will approximate $220,000,000. In addition, during these four years about $85,000,000 will be spent on township roads under the general supervision of the department of highways; making a total expenditure of $305,000,000 under the general supervision of Mr. Connell's department. This is probably a greater sum than has ever been spent on any engineering project, including the Panama Canal or the New York waterworks, in the same period of time, and there is no doubt but that just so long as transportation remains on terra firma the highway problem will be increasing from year to year.

MAJ. W. M. ACHESON, division engineer, New York State Department of Public Works, Syracuse, N. Y., said about New York's road-building program:

Last year the appropriation in New York state was $35,000,000, for one year's work. We placed under contract something like 600 miles, and completed as much as was placed under contract.

The minimum width highway on the main roads in New York state was 12 ft. It has gradually grown from 12 ft. to 14 ft., from 14 ft. to 16 ft., from 16 ft. to 18 ft., from 18 ft. to 24 ft., and finally to 27 ft.; 18 ft. is the minimum.

RUSSELL RAREY, Marble Cliff Quarry Co., Columbus, Ohio, gave in detail the principal features of the new Ohio road law, by the provisions of which a system of secondary roads is provided for, crossing the 11,000-mile system of main market roads, which is about 60% completed. The secondary roads will comprise about a 25,000-mile system. He gave these facts as evidence of continued interest in and expectation of highway building long after the possible completion of the primary road system.

GEORGE E. SCHAEFER, district sales manager, General Crushed Stone Co., Rochester, N. Y., gave a similar outline of the secondary road system of New York state. He said:

Most of the township roads in the state are constructed of whatever available local material they may have, for the bottom course; sometimes they import stone, but usually they build the road of a local material, and, on top of that, they lay their stone, and that is from 4 to 6 in. thick; some, more than others, depending on the traffic that goes over the road. That is bound by some bituminous material.

The state and towns and counties are building at the rate of about 1500 miles per year. We figure, and we hope, that within the next 30 years practically every township in New York will have its entire mileage covered with a good permanent surface.

Some of the counties in the state Erie, Munroe, Westchester, are already looking forward to the time when all roads will be hard roads. With the increase of motor vehicles and the increase of finances, we look forward to that.

I think that, within the next 25 years, practically all our roads will be hard surface roads, fit for any type of vehicle to go over.

P. B. REINHOLD, Pittsburgh, Penn., discussed the secondary road system of Pennsylvania.

Types of Roads

Concrete

Crushed stone producers are interested in furnishing material for all types of improved roads, but competition with gravel is keenest when the type of pavement built is portland cement concrete. A large part of the program was devoted to asphaltic road types, with the obvious object of getting quarry men to ally themselves with the interests promoting these types. However, concrete roads received almost as much attention. The most important contribution on concrete roads was by C. A. HOGENTOGLER, the National Research Council, giving some of the results of an extensive survey of existing concrete pavements, more particularly to determine the economic value of steel reinforcement as a means of preventing cracks. The conclusions from this investigation are as follows:

1. The amount of cracking and subsequent disintegrating is a function of time; thus, the rate of cracking is a measure of the life of the pavement.

2. The data show that steel reinforcement reduced the rate of cracking and thus increased the life of the pavement. This applies both to concrete pavements and other pavements laid upon a concrete base.

3. Crack reduction is more economically accomplished by the use of steel reinforcement than by additional thickness of concrete.

4. A greater reduction was afforded by small steel members closely spaced than by larger members wider spaced.

5. Increasing weight of mesh from 25 to 56 lb. per 100 sq. ft. considerably reduced cracking.

6. Mesh reinforcement, 25 to 56 lb. per 100 sq. ft., reduced cracks 35 to 70% in pavements of like thickness.

7. Mesh reinforcement, 25 to 56 lb. per 100 sq. ft. and bar mat reinforcement 64 lb. per 100 sq. ft.—25% additional—reduced cracks more than one additional inch of concrete, but one additional inch of concrete reduced cracks more than bars (42 to 48 lb. per 100 sq. ft.) placed transversely only.

8. With good crushed stone aggregate, 56 lb. per 100 sq. ft. mesh reinforcement, or 170 lb. per 100 sq. ft. bar reinforcement, 50% each way, caused a reduction in combined transverse and longtitudinal cracks equal to that indicated for 2 in. additional center thickness.

9. Mesh reinforcement of 38 lb. per 100 sq. ft. has been effective for a thin layer of concrete laid as resurfacing upon an old concrete road.

10. One additional inch of edge thickness reduced corner cracks more than mesh reinforcement 25 to 56 lb. per 100 sq. ft. or ⅜- to ¾-in. bar reinforcement, but progressive destruction following the appearance of corner cracks was arrested by steel reinforcement.

11. All types of steel reinforcement across cracks tended to hold together fractured slabs.

12. Bar reinforcement across transverse joint, without proper provision for slippage and clearance, resulted in breakage and subsequent expensive repairs.

13. For long slabs, 75 to 100 ft. or over, edge bar reinforcement with continuous bond caused corner cracks if the area of steel exceeded ¼ sq. in.

14. A remarkable agreement was found to exist between results of observations on roads in service and results furnished by a wide range of experienmental roads and laboratory tests.

Conclusions on Aggregates

Of course, the convention was mainly interested as to what conclusions could be drawn regarding the relative merits of crushed stone and gravel aggregates. MR. HOGENTOGLER was rather guarded in his statements on the subject but he did say:

As regards aggregate, at present, information in that form is not available. After seeing some seven thousand miles of road, during the past fifteen months, I am thoroughly convinced that such information exists in abundance. Much of the information has existed for years; it was literally waiting for someone to go out and bring it in.

* * *

In the reinforcement investigation we did not carry on one test; we did not build one road. Simply by looking at roads, we saw things that could not be duplicated for millions of dollars.

The same thing exists with aggregates. It differs, however, because tests also will have to be made. It is very apparent today that several different types of aggregate, under rigid inspection during construction, a year later show entirely different characteristics under actual service.

Now, in speaking of aggregates, I want to make this clear; I don't know much about them. We were not interested in aggregates in the investigation just carried on, but much to be learned was evident in going from place to place.

I have been misquoted on this one time, and I want to be very careful in expressing myself. In the first place, there are good crushed stone aggregates, and some that develop defects. There are gravel aggregates

that develop defects, and some that, apparently, do not develop these defects.

One of the first things we struck was the apparently excessive transverse cracking that developed with certain aggregates. I think the report of the National Pike, in Ohio, calls attention to the fact that certain gravel aggregates developed four or five times as many cracks as crushed-stone sections.

Now, as to this evidence, which exists; if one starts on Long Island, steps over to New Jersey, through New York state, into Pennsylvania, West Virginia and Ohio, out to St. Louis and North Carolina, he can come back with much information on aggregates.

There are places where you see slabs 75 ft. long, and adjacent to that, some of 15 ft. long; the difference is in aggregate. Some places have corner cracks, in one type running 24 to 1 in another type.

I was not interested in aggregates, but the comparisons stand out. In West Virginia we passed a little bridge, about a thousand feet, and I asked the engineer if it was the same kind of aggregate, and he said it was. We stopped and looked, and it was not the same; it had changed at the bridge.

As I say, the information is there, just waiting for someone to go out and get it, and, from my knowledge, it will not have to wait long to be made available.

Now, as to just what test could be made and used to identify the aggregates which go to excessive cracking. I don't know, but I venture the opinion that the test for tension might show something of that kind. The reason I think tension would do it is this: In the reinforcement we were considerably confused in certain types of gravel aggregate and slab lengths greater than 50 or 70 ft. This cracking developed, principally, in slabs of considerable length.

In the long slabs you have a pulling together, with contraction of the concrete, which would warrant a material of low tension resistance cracking.

When you put longtitudinal steel in these slabs you get a slight degree of cracking. If, in addition, you put some ⅜-in. cross bars, with the longtitudinal, you still further increase that cracking. That ⅜-in. bar has taken out ⅜ in. of your section of concrete.

If you change the ⅜-in. bar to a ½-in. bar you will probably get a little more cracking, because you are reducing the area of resistance to tension.

Now, changing from a ⅜-in. bar to a ½-in. bar, increasing the cross-section of the bar 33%, means a reduction of the area of concrete of 33%, accompanied by an increase of cracking, 28%.

That is the reason why, in our No. 8 conclusion, you will notice we specify "good crushed-stone aggregate." I don't know what "good crushed-stone aggregate" is. That term, as we use it, means good cruhed stone aggregate as used in Pennsylvania, which goes through for 1:2:4 mix; in North Carolina, it is not the crushed stone aggregate, which requires 1:2:3 mix.

I take a little of the reinforcement investigation results, simply to demonstrate that things can be learned from existing roads.

The idea is that roads are subject to so many conditions, traffic, grade, climate, and so forth that it is almost inconceivable that they could have any regularity or consistence, but we found it more or less the other way.

Take the base section, surface sections, plain or reinforced, you will find that loads did not increase the cracking, the longtitudinal cracks, over 1% from what existed before these loads.

Transverse cracks are usually caused by the climate. This is contraction. It is caused by contraction, which is dependent on climate. Sometimes they are 30 and 40 ft. apart, and this is caused by traffic.

The 15-ft. space cracks are the main ones to contend with. They don't seem to be much influenced with thickness in certain lengths.

Take center joint sections, full width sections. If you study the charts, you will find that, up to and including 6500-lb. wheel loads there is hardly any transverse cracking in any section, but when you change to an 8000-lb. load, there are changes, over 6, 7, 8, 9 in. cracked. There was a gradual reduction in the extent of cracking, and each of these thicknesses cracked at the same time.

So far as load cracking is concerned, we found one of the best roads obtainable, in Florida.

As regards sub-base or sub-grades, we don't have much information, but there is evidence that with a very hard compact road, stone sub-base, or possibly an old roadbed might not stop initial cracking, but it will absolutely prevent the slab from breaking down or deteriorating.

A softer sub-base might show less cracking at first, but when the crack occurs, it means replacing.

Another interesting thing is that there is an intimate relation between transverse and longtitudinal cracks.

Now, we get down to three primary influences in roads of the same section, same aggregate cracking, the function of age, disregarding traffic and location. At a certain age there is a change that occurs, and cracking is greatly reduced; take roads after that age, and cracking becomes a function of center thickness.

I think these are the only points I can give you, but there are 80 or 90 conclusions in the report.

Discussion of Mr. Hogentogler's Paper

WILLIAM L. BLAUM, New York State Bureau of Highways:

With the many conclusions drawn by Mr. Hogentogler I believe that most highway engineers will be in accord. The following conclusions are of interest and value.

"Plain concrete surface in widths greater than 10 ft. have developed longtitudinal cracks." This condition is now very largely eliminated by the use of the longtitudinal construction joint.

"Plain concrete surfaces have developed transverse cracks." There are some exceptions, however, to this general conclusion as for instance such portions of the South Glens Falls-Gansevoort Highway in New York State, mentioned in the report, that were laid on pure sand subgrade in 1915 and which are almost free from cracks of any kind. Such cracks can be reduced by using proper reinforcement.

"Cracking has been greatly influenced by character of aggregate." This is true both for fine and coarse aggregates. For instance, in some cases at least, other conditions being equal, pavements in which certain uncrushed gravels have been used as the coarse aggregate have developed more transverse cracks than where broken stone was used, for instance as given in the July, 1925, magazine issued by the U. S. Bureau of Public Roads. This does not mean that every crushed stone is better than every uncrushed gravel.

In this connection your earnest cooperation is requested in seeing that the broken stone, which is furnished for use in concrete pavements, complies with the following two requirements: (1) that the product delivered is clean; (2) that the product delivered conforms to the specification requirements with respect to sizing. Broken stone, the product furnished by the companies forming your association, can be regarded as a manufactured product. These two requirements are, therefore, within your control and can be complied with.

"Light mesh reinforcement placed with primary members perpendicular to the center line of the road has, in the same thickness of concrete, afforded a considerable reduction in transverse, longtitudinal and corner cracks." May not this conclusion suggest the benefit to be derived from the more extended use of bar-mat reinforcement of such cross sectional areas as may be effective and yet feasible to have fabricated at the mill as well as in the field.

"Probably the greatest effect from reinforcing occurred after cracks had formed, in that it held the pieces together, reduced ravelling and kept the surface even and reduced impact." Nearly all of these benefits were predicted when the use of steel reinforcement was first advocated for use in connection with concrete pavements. These effects actually obtained as well as the conclusions drawn from laboratory experiments indicate some of the essential qualities of steel reinforcement, i.e., the advisability of using a steel with a relative high elastic limit to hold the pavement together.

We might state that we may be, and often are, criticized for devoting so much time to the study of pavement failures. From such studies and investigations, however, many valuable lessons may be learned especially with reference to the inherent and acquired weaknesses of concrete pavements.

In studying this investigation, however, we must bear in mind that it covered but one phase of highway construction. Many other factors and conditions must also be considered. Successful highways depend on the following three factors:

1. Good and suitable materials.
2. Good and careful workmanship.
3. Correct and adequate design.

Under each one of these factors are several divisions and numerous sub-divisions all of which must be considered in the construction of a good highway. To be able to select the particular factor or set of factors or variables which would or would not make a good pavement under given conditions is a task of great magnitude.

Your association is primarily interested in the first factor, that of good and suitable materials.

C. A. MUNSON, New Haven Trap Rock Co., New Haven, Conn., said:

From Mr. Hogentogler's chart I dotted down in one column the stone jobs which he investigated, and in another column the gravel jobs. I added them and took their average. I left out a few that seemed to be mixed between the two jobs, therefore I don't think I arrived at an absolute result but I want to ask Mr. Hogentogler if I have arrived at an approximate result.

The result I made is this: The amount of crack reduction of wire-mesh-reinforced concrete pavement with crushed stone aggregate was 45% and the amount of crack reduction with gravel aggregate was 22%. To put it another way, the crack reduction with crushed stone aggre-

gated seemed to be twice as great as with gravel aggregate. I want to ask him if I am correct?

MR. HOGENTOGLER: I am glad to hear that. That is absolutely correct. It is a general comparison.

F. E. EVERETT, state highway commissioner of New Hampshire, in a paper describ the road improvement policy of his state, said that the early gravel roads were not standing up under present-day motor-vehicle traffic, and the 6 to 8 in. of cement concrete on top of the old gravel was the type of road which was the most satisfactory. He said most failures in concrete were due to the use of poor aggregates.

Asphaltic Road Types

PREVOST HUBBARD, chemical engineer, the Asphalt Association, New York City, presented the market possibilities for crushed stone in the building asphaltic road types as follows:

For many years past a greater yardage of asphalt roads and pavements has been constructed in the United States than of any other type of pavement of higher quality than water-bound macadam. From data at present available we have estimated that during 1925 not less than 140,000,000 sq. yd. of asphalt pavement, greater than the combined yardage of all other high type pavements, were constructed on the various state, county and city highway systems, and this figure does not include roads which were merely surface treated with asphalt or asphaltic oils, of which there was also a large yardage. The great majority of these asphalt pavements contained commercial crushed stone, and in a considerable proportion, crushed stone products constituted from 40 to 100% of the total mineral aggregate in the asphalt paving composition.

It is impossible to accurately ascertain the tonnage of crushed stone products consumed in this work, but a rough and probably very conservative estimate may be made by assuming that crushed stone was in about two-thirds of this yardage to an average extent of 50% by weight. If an average thickness of 2½ in. is assumed for the asphalt pavement proper, exclusive of foundation, with an average weight of 250 lb. per sq. yd., the quantity of crushed stone products used for such work in 1925 would be figured at over 11,000,000 tons. What proportion of the 1925 production of crushed stone this figure represents the speaker does not know as the latest government statistics are for 1924. It does however amount to about one-sixth of the reported tonnage of crushed stone for 1924. Foundations for asphalt pavements of course also consume a very large tonnage of crushed stone but if our present consideration is limited to wearing courses only it is evident that the crushed stone and asphalt industries have much in common.

In this connection it may be of interest to you to review the statistics of production of both industries during recent years. Taking production during 1919, the first post-war year, as 100 and plotting the annual production of both industries to 1924, it will be found that their growth curves correspond quite closely. Thus in 1923 both showed an index of about 185 which was considerably higher of than of other highway material industries, with the exception of gravel. From the figures at present available, the 1924 production index of both are higher than for any of the others, amounting to 200 for crushed stone, and about 239 for asphalt. The nearest competing highway material to asphalt shows a 1924 index of 174. The asphalt industries continued to grow in 1925 and an estimate of production during that year gives an index of about 260. Prospects for 1926 indicate a decided continued growth and the speaker ventures to prophesy that this growth will materially boost the production of crushed stone. Thus if the average rate of growth for asphalt pavements during the past six years is projected into the future an annual increase of not less than 1,000,000 tons of crushed stone products required for the construction of this increased yardage, should follow.

So far we have considered only asphalt pavements proper which are standard types of wearing courses with an assured place in the nation's highway construction program. In addition there are thousands of miles of water-bound macadam roads which must be maintained with surface treatments of asphalt, asphaltic oils or other bituminous materials to justify their existence or future construction for even moderate traffic. Statistics compiled by the U. S. Bureau of Public Roads showed that on January 1, 1922, there were over 19,000 miles of surface-treated macadam on the rural highway system of the United States and that during 1922 some 613 miles of such roads were constructed. These are the most recent available figures which are authentic but if annual construction of same additional mileage is assumed for 1923 to 1925 inclusive, the total of such rural roads at the present time would be about 21,000 miles. A considerable yardage of similar roads exists within the corporate limits of nearly all of our cities and while no reliable information on the subject is apparently obtainable it is believed that such construction will total not less than 5000 miles. As a basis for this estimate it may be stated that on January 1, 1923, a census of paving types in cities representing about two-thirds of our urban population showed approximately 8000 miles of combined water-bound and surface treated macadam. If the estimated urban mileage of surface treated macadam is added to the rural mileage a grand total of 26,000 miles is obtained.

A considerable proportion of such roads is maintained with annual surface treatments of bituminous material and a covering of small size crushed stone. If, however, an average period of two years is assumed between treatments and only half of the total mileage is credited to treatment with asphaltic products it is readily seen than some 6500 miles of macadam roads are so treated each year. On the basis of an average width of 15 ft. the amount of crushed stone cover required for this surface treatment can be figured at about 1,500,000 tons annually.

From the foregoing it would appear then that not less than 12,500,000 tons of crushed stone products are used annually in the construction of asphalt wearing courses and surface treatments, which amounts, I understand, to about 25% of the tonnage represented at this convention. In addition through normal growth of the asphalt industry an increased consumption of not less than 1,000,000 tons of crushed stone may be expected each year. And this does not take into account crushed stone used in the construction of foundations for these asphalt highways. Crushed stone used in foundation construction for asphalt pavements is very difficult to estimate. An unknown proportion of the yardage of asphalt pavements is constructed on existing old roads which are thus utilized as foundations with or without an increase in thickness. Moreover there are a number of types of foundations in connection with which no data is available as to the relative amounts of crushed stone and gravel consumed. Taking everything into consideration, however, it is believed that approximately the same amount of crushed stone is annually used in the construction of foundations for asphalt pavements as in the pavements themselves so that on this basis the total consumption would be about double the figures already given.

With this admittedly crude attempt to develop some of the existing highway requirements of mutual interest to the crushed stone and asphalt industries let us turn our attention for a few moments to prospective new developments in highway construction which may also prove to be of mutual interest, and well worth co-operative effort in their furtherance.

(The rest of Mr. Hubbard's paper was an argument in favor of "black base" pavements.)

F. E. EVERETT, state highway commissioner of New Hampshire, in describing the resurfacing of many old gravel roads in his state, gave his experience with the use of smaller sizes of trap-rock, asphalt treated. He said he was leaning more and more to this type of improvement for many miles of gravel roads.

G. A. HUTCHINSON, Kentucky Rock Asphalt Co., Toronto, Ont., gave a sales talk on "Kyrock," the product of his company. This was addressed to crushed stone producers because this natural rock asphalt is ordinarily specified to be placed on a crushed stone base. His paper dealt with the history, nature, preparation and use of crushed rock asphalt.

Special Types of Roads

MR. GOLDBECK, in his discussion of research, touched on the possibilities of developing types or designs of pavement or road improvements which would increase the demand for the smaller sizes of crushed stone such as screenings. He spoke with the knowledge that some progress in that direction had already been made.

W. SCOTT EAMES, general manager of the New Haven Trap Rock Co., New Haven, Conn., said:

Stone screenings, which we thought a waste product a few years ago, have been gaining in demand with us, because they have been found so useful in hardening both clay and sandy dirt roads.

Mr. Goldbeck has, however, touched upon another use for screenings, which promises great possibilities, namely, their use as a blanket coat over poor soils before concrete or bituminous surfaces are laid.

Our states are spending, and spending wisely, large sums in excavating these poor soils and replacing them with gravel. In particular instances the placing of perhaps a 3-in. insulating layer of stone screenings over this soil would produce the required results. The states might save great expense, and our industry would be benefited.

Railway Ballast

The next largest market for crushed stone, after highway construction, is for railway ballast. In this field, also, competitive materials have made much progress, so that the following remarks are of more than ordinary interest.

F. J. STIMSON, assistant chief engineer, maintenance-of-way, Pennsylvania R. R., discussed the use of crushed rock ballast something in the vein of a thoroughly seasoned railway maintenance engineer thoroughly sold on the superiority of rock ballast, but battling in his committee work for the American Railway Engineering Association with younger engineers who were enthusiastic concerning the virtues of washed gravel ballast. Mr. Stimson said that crushed-stone producers must do their part well to maintain their place as ballast producers, must rigidly live up to specifications, and must give the best of service.

The ballast committee of the American Railway Engineering Association, of which Mr. Stimson is chairman, is now trying to evolve a formula which will determine mathematically the relative values of various kinds of ballast, taking into account all factors, such as first cost, labor cost of placing, cost maintenance, drainage, riding qualities, etc. Mr. Stimson sketched the vast changes that have taken place in requirements for ballast during the 40 years he has been in railway work. First-class track on the Pennsylvania Lines today requires 12 in. of sub-ballast and 12 in. of standard ballast. Gravel ballast is becoming popular, he said, because it is cheap and easy to put down, the costs are less all the way through.

A. C. MacKENZIE, engineer, maintenance-of-way, Canadian Pacific Ry., said his railway had rock-ballasted 1000 miles of main line in the last 10 years, mostly with limestone or dolomite.

M. S. BLAIKLOCK, assistant chief engineer, Canadian National Rys., said:

On the Canadian National we have not so far advanced very much with our rock ballast. As a matter of fact, we have only started. Our financial problems were too great to permit of the expenditure. For many years we have had to conduct our transportation with run-of-pit gravel. A year or two ago, however, we decided we had to make progress, and to create a greater stability of track. We had provided better rails, and better, stronger and larger ties, but we felt the main thing needed to support our track and carry the load was the ballast. The condition of the ballasting of a railroad does not become so apparent as the condition of the ties and the rail, particularly to railroad officials and executives. The ties and the rails speak for themselves very quickly, and an unsatisfactory condition of ties and rails is due, possibly, to a too elastic and insufficient amount of ballast. We need the ballast to carry the load from the tie to the roadbed, and we need it in order properly to support the wheel loads passing over the rail.

I was glad to hear Mr. Stimson's remarks with reference to the quality of the ballast. As he said, the quality of the rock in the quarries varies greatly, and it is necessary in order that we get uniformity in our surface and in our track conditions that we should have every carload of the same quality of rock supplied for ballast.

J. V. NEUBERT, engineer of maintenance-of-way, New York Central R. R.:

I made the remark last year that washed gravel, hard slag and crushed stone as ballast for roadways was in its infancy. Since then I have spoken to a number of railroad officials both in the financial and maintenance departments, and I was surprised to learn the number of roads which have been using rock ballast in permanent roadbeds. You heard Mr. MacKenzie, of the C. P. R., state the number of miles on their road. Just think of it, 1000 miles. I do not believe any road in the United States can equal the figure.

* * * * * *

Rock gives you a permanent roadbed, and permits you to work your roadbed conditions at least one, if not three months, more per year.

* * * * * *

The proper size of the ballast is important. Do not use it oversize. We have found that by putting in the proper size material, to the proper depth, it is prevented from working into the finer ballast, and you do not have a choppy track. You should work upon the principle of applying your ballast to certain standards, and you should have it to the proper depth, not like the designs of the ladies' skirts.

Ballast Committee Report

JOHN RICE, president, General Crushed Stone Co., Easton, Penn., reported as chairman of the N. C. S. A. ballast committee as follows:

In preparation for the convention of the association in Cincinnati in January of 1925, I sent out as chairman of the ballast committee a questionnaire to every railroad in the United States and Canada. The questionnaire contemplated, as far as possible, the securing from the railroads the amount of ballasting they had done in the past, the amount done the previous year, and that which was contemplated for the season 1925.

In addition to this, the officials were asked if they subscribed to the order of merit which the various materials suitable for ballast possess as set forth on page 70 of the Manual of the American Railway Engineering Association of 1921. The order of merit referred to was substantially as follows:

Trap rock or granite.
Limestone or sandstone.
Washed and crushed gravel.
Blast furnace slag.
Screened and pit run gravel.

There was, however, no relative value of these various materials assigned in the manual. It was therefore sought to obtain the opinions as to the relative merits of these various substances, believing that the information would be of value both to the railroads and producers of the various articles.

Replies were received from 50 different railroads, aggregating a trackage of 110,359 miles, and these railroads represented 75% of the most important ones on the continent. A number of the replies were received subsequent to the convention in 1925 and many of them entirely too late to attempt to make any digest of the information. Such digest, however, was made for the convention of 1926 and below is a summary of these reports.

"Do you subscribe to the order of merit which the various ballast materials possess as set forth on p. 70, Manual of the American Railway Engineering Assn. of 1921?"

Ninety per cent answered "Yes."

Number of miles of trackage under the jurisdiction of the 50 railroads answering, 110,359.

	Relative percentage of merit	Estimated annual percentage of ballast in full ballasted track required for maintenance
Trap rock or granite	100%	3.3%
Limestone or sandstone	87%	4.6%
Washed and crushed gravel	78%	5.97%
Blast furnace slag	68%	7.9%
Screened and pit run gravel	61%	9.9%

The difficulty of making this digest was due to the fact that very few engineers answered all the necessary questions and it was therefore necessary to supply data by proportion, interpolation, and average such information in each report as was lacking and then finally average all the reports. The result is the average of all the reports, without giving weight to the opinions of more prominent engineers or engineers of the larger railroads as compared with engineers of lesser reputation, or those connected with smaller roads, for the reason that the mere size of the road did not necessarily imply that its representative's knowledge was in proportion to its size. At any rate, the result is an average of individual opinions and compiled as sincerely as was possible under the circumstances. Whether the results are right or wrong may be a matter of opinion, recognizing of course that average opinions at any rate do not represent truth.

The Market for Agricultural Limestone

Of growing importance to every limestone quarry is the expanding market for screenings and pulverized stone as agricultural limestone or "agstone."

C. M. DOOLITTLE, president, Canada Crushed Stone Co., Ltd., Hamilton, Ont., said:

The use of agricultural lime is still in the pioneer stages in Canada. The Provincial Department of Agriculture is advocating the use of lime. An alfalfa campaign is now under way, which will mean the increased use of lime. Through the efforts of the agricultural enquiry committee of the provincial legislature the railways gave a voluntary reduction in freight rates on agricultural limestone. Much missionary work still remains to be done, but we have had an encouraging increase in tonnage in 1925, but look forward to better business in 1926.

COL. O. P. CHAMBERLAIN, general manager, Dolese and Shepard, Chicago, Ill., said:

The production and sale of agricultural limestone during 1925 was very gratifying to the business in our district. From 1921 the agricultural limestone business languished, due, probably, to the inability of the farmers to purchase agricultural limestone. Personally, I have always felt that the farmers would purchase it if they had the money. They seemed to be in a bet-

ter position last year, and we did a business far above normal in agricultural limestone. Many of us improved prices and conditions which had prevailed, and, upon the whole, we did a very satisfactory agricultural limestone business.

P. B. REINHOLD, Pittsburgh, Penn.:

The agricultural limestone business was about normal during 1925, but we look forward to increased shipments during 1926.

E. J. KRAUSE, president, Columbia Quarry Co., St. Louis, Mo., said:

One notable point of interest is the tremendous increase in the use of agricultural limestone. The tonnage for 1925 was 750,000 tons, and I believe 900,000 or perhaps a million tons would have been used had it been available. Practically for the first time in the history of the crushed stone industry there is a market for the ¼-in. size and smaller.

PROF. FIRMAN E. BAER, Ohio State University, Columbus, Ohio, read a paper entitled, "Limestone for Plants, Animals and Men," which is given in substance in what follows:

There is no fact in science which has been more conclusively demonstrated than that of the necessity for lime in human, animal and plant economy. Many of the ailments of the human race may be credited to a lack of mineral elements in the diet of which calcium is one. Lime enters into the structure of bones and teeth. It has been conclusively demonstrated that a diet which is deficient in lime will not produce a normal, healthy child. Similarly it has been shown that if cows are fed a ration which is lacking in lime they ruin their own bodies in order to secure the necessary amount of this material with which to construct the bones of their offspring. Moving down one step farther to the plant kingdom from which man and other animals secure their food for energy and growth, we do not find a single plant which does not contain considerable amounts of element calcium, the basic ingredient of limestone.

Picking Men From Limestone Countries

A few years ago in teaching a class in soil management at the Ohio State University, I ventured the assertion that one could tell from a man's appearance whether or not he came from a limestone country. The class seemed to doubt my ability to do this. Accordingly I looked over the 150 men who comprised the class and selected a long, lean specimen of humanity from their midst and asked him where he was born. To the amazement of the class and my own relief, he admitted that he came from Muskingum county, Ohio, where practically all of the soil needs lime.

Probably one might not always be so fortunate in his choosing. There are tall men, lean men and fat men and men of a variety of descriptions in every locality no matter what the nature of the soil. But it seems reasonable to believe that if the diet of human beings is confined to vegetables, grain and livestock products which have had their origin in acid soils, the effect will in time be apparent in the reduction in their vitality.

There is a legend of American origin which says that "a limestone country is a rich country." That has been the experience of our farmers. Not only do the crops grow better and the grass more luxuriantly on such soils, but the livestock are in better condition and put on fat more readily and the people themselves tend to have larger and more muscular frames and more vigorous constitutions. One does not need to test the soil to tell whether or not there is carbonate of lime in it. The nature of the crops, the condition of the livestock and the appearance of the people themselves tell the story. There is no known substitute for lime.

Some years ago the International Harvester Co. published an attractive bulletin, with a still more attractive title, which stated that "Folks and Fields Need Lime." In this bulletin, the thesis was developed that the method which most effectively insures that folks will get this lime is that of first putting the limestone on the soil and then eating the products of this limed soil. In other words, the bulletin said that applying limestone to the soil guarantees not only larger yields but crops containing more lime and therefore better suited to the needs of man and other animals. There is nothing wrong with that argument.

Perhaps it would be just as well to feed the limestone to the livestock and to ourselves in tablet form. In fact the effectiveness of mineral mixtures for hogs, grit for chickens and concentrated feeds for cattle may be credited to a greater or less extent to the carbonate and phosphate of lime which these materials contain. But the surest way to guarantee an adequate amount of lime in the food is to sow the seed of those plants which are most sensitive to acid soils and then put on enough limestone to make them grow. This system not only works but it pays. Limestone is one of the cornerstones in the foundation of profitable agriculture.

The recognition of the importance of limestone in agriculture is international in its scope. In Germany, Denmark, the Netherlands, Belgium, France and England, those European countries which produce the highest acre yields and where farmers enjoy the most substantial prosperity, lime in one or another form has long been used. Its value for soil improving purposes was known before the birth of Christ. Since that time there has been recurring cycles of favor and disfavor in which lime has been held. The peaks of its use in Europe were during the early years of the 12th century, again in the 16th, the end of the 17th and the beginning of the 19th and 20th centuries. We are now on the upward trend of a curve to which there should never be a decline.

Early Use of Land Plaster

The explanation of these cycles is to be found in the lack of knowledge concerning the requirements of plants and the peculiar function which lime performs. Lime is not the only chemical substance which has gone through these cycles of popularity and disfavor. Land plaster, a combination of lime and sulfuric acid, was once used in considerable amount in Europe and the practice was carried over to this country by the German farmers. Benjamin Franklin is reputed to have written "This land has been plastered" on a hillside near Philadelphia treated with land plaster. Later the dark green growth of grass made its use very apparent to the passerby. Most farmers of today have never even seen land plaster. Yet it is interesting to note that the acid phosphate which has been so popular during the last 25 years contains about 50% of this material.

Someone has said that "plants are not made of nothing." It might be well to add that neither are they made entirely of any one element. Land plaster contains calcium tied to sulfuric acid. Our modern acid phosphate contains land plaster plus phosphate of lime. Other fertilizers supply nitrogen and potash. The plant further requires iron and magnesium from the soil. A deficiency of any one of these materials reduces the yield of crops. Another and even more important requirement of plants is that the reaction of the soil solution be kept from getting too acid. Controlling the soil reaction is the one important function of limestone. Except as difficulty arises in this connection, there is little to be expected from its use. Limestone may be said to function primarily in the soil and secondarily in the plant.

A large part of the science of soils has been pieced together during the last 25 years. One of the most difficult problems which the soil scientists have had to deal has been that of acid soil. That lime was an effective material to apply on such soil had long been known. That it functioned, at least, in part, in destroying soil acids has been understood for more than a century. Edwin Ruffin wrote a series of articles on liming for the *American Farmer* in 1821 which later appeared in book form under the title of "Calcareous Manures." In this book there is a very good discussion of the importance of marl for correcting soil acidity.

But while it was known that soils on being farmed tended to become acid; little was known concerning the nature of these acids. We are still very much in doubt concerning the nature of the compounds in soils that are responsible for the acid condition which obtains in a large percentage of them. Fortunately, we now have an electrometric method which tells us just how acid soil is and enables us to determine just how much effect an application of limestone has had in overcoming this acidity. Irrespective of the acids in soils that are responsible for the acid tive acidity at any time. Our problem today is one of finding the answers to two major questions:

1. What are the optimum soil reactions for the several crop plants of the bacteria related to their growth.

2. With what factor or group of factors is the ability of an acid soil to maintain an acid reaction correlated?

Importance of Legumes and Limestone

The indications are that, in extensive farming, the soil must be brought to the optimum reaction for the key legume crop of the rotation, at least during the period when it is being grown. The sequence may be so arranged that the crops will appear in the descending order as to their sensitiveness to acidity. With this in mind, it is apparent from investigational data now available that the producers of agricultural limestone should interest themselves in encouraging the growing of the lime loving legumes, particularly alfalfa and sweet clover. Whenever the soil has reached a high enough plane of productivity to grow alfalfa luxuriantly (and this is seldom possible on an acid soil) then it will produce high yields of almost any other crop which one might desire to grow if that crop is adapted to the climate conditions which obtain. It is the common practice in Northern France and Belgium to grow alfalfa once every 10 to 12 years, the other years being devoted to grain crops and sugar beets or similar cash crops. This means that each time the alfalfa appears in the rotation con-

sideration must be given to the problem of liming the soil.

If we assume that ultimately the level of productivity will be raised to that which permits of the successful growth of alfalfa, then we might calculate what the limestone needs to the United States would ultimately be. However, it must be kept in mind that the loss of limestone from the soil through removal in crops is small as compared to the losses of drainage. In fact, acid soils are the rule only in humid climates. In the United States there are large areas of alkali land and other large areas where the rate of evaporation is so high that even though the rainfall is quite abundant the drainage losses are relatively small. The acid soil belt extends from Iowa to the Atlantic Coast and from the Great Lakes to the Gulf of Mexico with the most acid in the regions of heaviest rainfall.

It is not safe to assume that all of the acid soil in America will be limed in the very immediate future. The South carries on a system of agriculture in which the minimum amount of limestone is required. In fact, limestone is not used to any considerable extent south of the Mason and Dixon line with the exception of a few areas in Kentucky and Tennessee. On the other hand, the consumption of fertilizers is much higher in the South than it is on similar land and for similar crops farther north. It is possible to do without lime if enough fertilizer of the right kind is used and if the less sensitive crops are grown. The South is following that practice.

However, the more or less different systems of soil management of the past will not meet the needs of the future. The exportable surplus of food stuffs in the United States diminishes each year. It is estimated that our present food surplus would feed about 20,000,000 people. It is expected that our population will increase by that many millions within the next 12 to 15 years. The virgin productivity of our soils has been largely exploited. From now on we must add to the soil fully as much of the essential soil elements as the crops remove, if we are to increase our level of production to meet the needs of a population conservatively estimated to be 200,000,000 by the year 2040.

Providing Food for Future Populations

Our present level of crop yields is not high enough to give adequate returns for labor and capital invested. It may seem ridiculous now, but one may well question whether it is safe to have too narrow a margin between us and famine. Ireland lost 600,000 people when her potato crop failed because of blight. What the corn borer menace may mean to America remains to be seen. Our surplus food supply may be wiped out in a relatively few years. Certainly the population is overtaking the food supply. The Malthusian doctrine again merits consideration. Without question higher acre yields must be produced. For these, a larger use of limestone and fertilizers is essential.

Perhaps the one question which has troubled the limestone producer most is that of fineness. The answer to this question is yet to be given. In general it may be said that the limestone screenings have been most popular in the extensive farming sections of the West while the finely pulverized quicklime and hydrated lime have been more largely used to the East. However, one of our Western experimental stations has recently published a bulletin which indicated a belief on the part of the agronomists of that station that the limestone should be pulverized, to pass a 10-mesh sieve in order to be sufficiently rapid in its effect. On the other hand, there has been an increasing interest in ground limestone in the Eastern states. It must be admitted that there is a degree of fineness beyond which no further increase in efficiency is likely to obtain. The limitation to effectiveness is found in the machinery for distribution and subsequent mixing with the soil rather than in the state of division of the material, after a given size of particles has been passed. Certain types of liming materials tend to undergo further reduction in the state of division when they are applied to the soil. There are the further economic problems of the cost of increased fineness viewed from both the producers' and the consumers' point of view.

If coarse products are to be used, we believe that there are good arguments for applying them on the surface as long as possible before they are plowed under or mixed with the soil. This permits of more rapid disintegration, solution and distribution than would likely take place if these particles were surrounded on all sides by soil. Very remarkable effects on pastures and young clover have been noted following the use of coarse limestone on the surface of the land.

Magnesium Limestones Must Be Finer Ground

In the event that the stone contains considerable percentages of magnesium carbonate, fineness is more important than is the case with high calcium stone. There is not much difference between the efficiencies of 100-mesh material from high calcium and the high magnesium stones but there is considerable difference in the case of the 4-mesh products.

It is our opinion that limestone is more useful and effective in the Northern than in the Southern part of the United States. Where sessions are short, the process of nutrification needs to be stimulated as much as possible. Limestone is effective in this connection. In areas where the soil is frozen during a large portion of the year, the rate of disintegration and decomposition of soil materials is less than it is where the temperature is more mild. As a result, the critical point in acidity may be reached in colder regions in a soil which if moved farther south would still grow crops satisfactorily without limestone.

In general, we believe that, once the soil becomes acid, the use of two tons of limestone per acre every six to ten years is necessary for the production of high acre yielding of the more desirable crops. When more food is required, the consumer of this food must expect to pay for that amount of limestone. Assuring that no more than that amount of limestone is to be used, then we believe that most of the products should pass a 10-mesh sieve and that a considerable percentage should pass a sieve with 100 meshes to the inch. In some cases, economic conditions will justify the use of coarser product. In other cases, they will make it necessary to use burned lime. No one rule can be applied to all cases.

Questions Answered

In answer to various questions put to him following the reading of his paper, Prof. Baer said further:

At the present time they are using between 250,000 and 300,000 tons of agricultural limestone in Ohio. We have about 10,000,000 and 11,000,000 acres of land under cultivation, and we figure we should be using from 1,000,000 to 2,000,000 tons of limestone per year.

We recommend it should be put on at any time of the year when it is convenient, irrespective of the state of the soil. We believe the coarser product can be put on at any time without preparation of the soil, but it should be plowed in only a long time after. If the land is already plowed the application should be made shortly after the plowing, and cultivated into the soil as cultivation proceeds.

So far as the soil is concerned we see no objection to 50% silica, but ordinarily it is not desirable to pay freight on material which contains more than 15% of impurities. Ordinarily a limestone containing 85% of carbonates is an undesirable product, both from the point of view of the producer and of the consumer. It will wear out the machinery, and it will wear out the pocket of the man who pays the freight on it.

The reason we do not care to make a recommendation as to fineness is this: If you put it all through a 20-mesh screen, there would be a considerable amount of it which would go through a 200-mesh screen. The average has been made to pass the 100-mesh screen, and probably further reduction would not improve its efficiency, because after you get to a certain stage of fineness the efficiency is no longer determined by the state of fineness but by the machinery for distribution. If you had a large quantity of very fine material and applied it in one spot, the mere fact of its fineness would very much increase its efficiency, but I do not believe you gain anything over passing it through, say, a 100-mesh screen, unless you have a method of distribution more efficient than anything we now have. If you had it in a pot, and mixed it with the soil by hand so that you had a thorough mixture, there is no question in my mind but the increased state of division would be an advantage, but everyone knows there is not any mechanical process possible that will mix it with the soil as thoroughly as is required for its highest efficiency.

Limestone Dust for Coal Mines

As a market for limestone quarrymen the increasing use of limestone dust as an explosion preventive in coal mines offers some opportunities. It was briefly referred to by Mr. Goldbeck in his discussion of research. The only other reference to this market was by P. B. REINHOLD, of Pittsburgh, Penn., who said:

As concerns the business available for the rock dusting in bituminous coal mines we find that many of the coal operators are installing their own machinery for crushing the local mine slate. This material is, of course, highly silicous and injurious to the miners. Another obstacle in this business is the fact that so many of the coal mines have been closed for months. In spite of the fact of the constant urging by the United States Bureau of Mines that rock dusting be done in all mines, using limestone as the dusting material due to its being free from silica and its illuminating features, nevertheless many of the operators are not now dusting their mines, which has resulted in serious accidents causing the deaths of over 100 men in the bituminous field.

Preparation of Crushed Stone for Marketing

The thorough preparation of crushed stone for the various markets was emphasized by Mr. Goldbeck in his discussion of research. Others who spoke on this subject, and what they said, follows:

MAJ. THERON M. RIPLEY, division engineer, New York State Department of Public Works, Buffalo, N. Y.:

From the point of view of the "highwayman" you can give service not only in prompt delivery but also in quality of product, viz., both kind and size of stone required and stone which is clean.

In our work in New York state washed stone has not been much, if any, of a factor; but the speaker has been compelled to reject stone and cease shipments because the stone was too dirty.

The standards of all road construction are constantly improving and the materials must likewise improve. You must watch the trend of these improvements not only in highway work, but in other construction and be ready to meet it. Some may be ready now, and others may never be ready. These improved conditions, may, in some instances, compel the sorting of materials in some quarries, and in order to hold your business, you will have to sort your stone either in the ledge or later.

Mr. Blaum did not bring that point out, but it is very serious in some portions of the United States. I know two different quarries, quite widely separated, where stone from one portion we had to reject, yet the stone from another part was just what we needed.

COL. O. P. CHAMBERLAIN, general manager, Dolese and Shepard Co., Chicago, Ill., chairman of the standardization committee of the association, discussed the possibility and feasibility of standardizing crushed stone sizes as follows:

The standardization of sizes of stone would apparently be beneficial to quarrymen throughout the country. At the present time, however, sizes are so affected by local conditions, as well as by state highway specifications and engineers' and architects' specifications, that the standardization by the National Crushed Stone Association cannot be made effective without the co-operation of other organizations. In this connection there follows the proposed revision of the present tentative standard specification for commercial sizes of broken stone and broken slag, serial designation, D63-23T, of the American Society for Testing Materials. This is published as information and for study by members of the National Crushed Stone Association. Should the American Society for Testing Materials adopt a standard, it is quite probable that such standard should also be made the standard of the National Crushed Stone Association. It would be folly for this association to attempt to establish a standard at variance from that of the American Society for Testing Materials.

Let it be understood, therefore, that the including of this proposed revision of sizes of crushed stone is not in any sense a recommendation of your committee but only information that should be of interest to members of this association.

Explanation of Suggested Changes

Designated Size 0-1 1/4 in. Attention was called to the necessity for controlling the amount of fine material in screenings for waterbound macadam. It was proposed to handle this by a footnote as shown.

Designated Size 1/2 in. This size was criticized because it represented not only a product containing a large percentage of crushed dust (75%), but also included material none of which passed the ¼-in. screen. It was felt that these were different products used for two distinct purposes. For this reason the 0-½-in. size in the new table carries 15-75% passing the ¼-in., and a new size (¼-in.-½in.) has been inserted to provide for the need of ½-in.-¼-in. dustless screenings.

Designated Size 0-3/4 in. This size was criticized mainly because of the fact that a larger proportion of material is allowed to pass the ¼-in. than in the case of the 0-½-in. size, whereas the reverse would probably be the case in the ordinary run of the crusher. Accordingly, the per cent passing the ¼-in. for this size has been changed to 15-75 instead of 40-80. The object of the 15% limit is to prevent overlapping with the ¼-in-¾-in. size, which provides for as much as 15% below the ¼-in. screen.

Designated size 1/4-3/4 in. was not criticized.

Designated Size 1/4 in. x 1 1/4 in. was criticized on account of low minimum limit passing the ¾-in. screen. 25%. This limit has been changed to 40%, because it was felt that a more satisfactorily graded aggregate for concrete would thereby be secured.

Designated Size 1/4-2 1/2 in. was very severely criticized by a number of engineers in connection with its use as coarse aggregate in concrete road construction. The principal objections were that the range in sizes was not closely enough defined and that a product entirely too coarse graded for satisfactory results would be possible under this specification. It was also criticized by a number of engineers because of the maximum size of 2½ in., the statement being made that in the majority of states having large concrete paving programs the maximum size was 2 in. Accordingly, another size has been inserted to be known as *Designated Size* ¼-in.-2-in., with permissible variations as indicated in the table, and corresponding changes in permissible variations made in *Designated Size* ¼-in.-2½-in. It will be observed that limits on an additional screen are inserted in both cases, the ½-in. screen being used for the ¼-in.-2-in. size and the ¾-in. screen for the ¼-in.-2½-in. size. The object of limits on these sizes is of course apparent, in that a certain amount of fine material is thereby insured.

Designated Size 3/4-1 1/4 in. was not criticized.

Designated Size 1/4-2 1/2 in. was criticized on account of the fact that there was no intermediate screen size specified. This addition was accordingly made in the new table. In addition to the above changes, it will be observed that 100% must pass in all cases the screen next larger in size to the maximum nominal size of the product.

Very strong representation was also made regarding the necessity for an additional size vs. ½-in.-1-in., or commercial ¾-in. stone. This size has been inserted together with corresponding permissible range in mechanical analysis. The following are the purposes to which the various sizes of crushed stone or crushed slag above specified are adapted:

Designated Size 0-1/4-in.—Fine screenings for water-bound road construction.

Designated Size 0-1/2-in.—Aggregate for fine graded bituminous concrete.

Designated Size 0-3/4-in.—Coarse screenings for waterbound macadam road construction or aggregate for bituminous concrete.

Designated Size 1/4-1/2-in.—Fine dustless screenings for bituminous road construction.

Designated Size 1/4-3/4-in.—Coarse dustless screenings for bituminous road construction; coarse aggregate for cement concrete where the maximum size is limited to ¾-in.

Designated Size 1/4-1 1/4-in.—Coarse aggregate for coarse graded bituminous concrete; coarse aggregate for cement concrete where the maximum size is limited to 1¼-in.

Designated Size 1/4-2-in.—Coarse aggregate for cement concrete pavements or

MAXIMUM PERMISSIBLE RANGE IN MECHANICAL ANALYSIS FOR EACH SIZE
(Percentage by weight passing laboratory screens)

Designated Size Inches	Diameter of Screen Openings Inches										
	¼	½	¾	1	1¼	1½	2	2½	3	3½	4
0 - ¼*	85-100	100	.....	.....	.....	.....	.....	.....	.....	.....	.....
0 - ½*	15-75	95-100	100	.....	.....	.....	.....	.....	.....	.....	.....
0 - ¾*	15-75	.....	95-100	100	.....	.....	.....	.....	.....	.....	.....
¼ - ½	0-15	95-100	100	.....	.....	.....	.....	.....	.....	.....	.....
¼ - ¾	0-15	25-75	95-100	100	.....	.....	.....	.....	.....	.....	.....
¼-1¼	0-5	.....	40-75	.....	95-100	100	.....	.....	.....	.....	.....
¼-2	0-5	5-25	.....	40-75	.....	.....	95-100	100	.....	.....	.....
¼-2½	0-5	.....	10-25	.....	40-75	.....	.....	95-100	100	.....	.....
½-1	0	0-15	25-75	95-100	100	.....	.....	.....	.....	.....	.....
¾-1¼	.....	.....	0-15	25-75	95-100	100	.....	.....	.....	.....	.....
1¼-2½	.....	.....	.....	.....	0-15	.....	25-75	95-100	100	.....	.....
2½-3½†	.....	.....	.....	.....	.....	.....	.....	0-15	25-75	95-100	.....

*Designated sizes 0-¼, 0-½, and 0-¾, when used as screenings in waterbound macadam road construction shall conform to the following additional requirement: Passing No. 100-mesh sieve, 6-12%.

†The lower limit for Designated Size 2½-3½ may be changed to 2 in., when necessary to utilize the product of a crusher producing Designated Size ¼-2 in.

The upper limit for Designated Size 2½-3½ may be changed to 4 in. in the case of very soft stone or light or porous slag.

other concrete structures where the maximum size is limited to 2 in.

Designated Size 1/4-2 1/2-in.—Coarse aggregate for cement concrete pavements or other concrete structures where the maximum size is limited to 2½ in. As coarse aggregate for bituminous concrete base.

Designated Size 1/2-1-in.—Commercial ¾-in. stone for bituminous road construction.

Designated Size 3/4-1 1/4-in.—Commercial 1-in. stone for bituminous road construction; binder stone for sheet asphalt, etc.

Designated Size 1 1/4-2 1/2-in.—Coarse aggregate for bituminous macadam penetration method and bituminous macadam base; also wear course water-bound macadam.

Designated Size 2 1/2-3 1/2-in.—Coarse aggregate for bituminous macadam base or base course water-bound macadam.

There are in existence two diametrically opposed systems of numbering stone.

In this connection I have inserted in our report the recommendations of the committee appointed by the American Society for Testing Materials, possibly to replace the tentative sizes of stone already adopted by that organization. This has been pointed out to me, and, I think, to all the members of our committee, by Mr. Goldbeck, but I believe it has not been pointed out to the association generally.

I feel if we are to go into the matter seriously we must be guided to a great extent by the experience and advice of Mr. Goldbeck.

The matter was considered very briefly in the session of the committee the other day, at which there were 14 members present, and the consensus of opinion amongst those gentlemen was that we should, if possible, attempt to reduce the number of different sizes shown on the table.

I think I sense the feeling of the average crushed stone manufacturer when I say it is not policy and it is not economy from the manufacturers' standpoint to have a multiplicity of sizes of crushed stone, standards or not standards. We have, however, found we have been compelled to change our screens and put in screens different from those we had been using, because of the specifications furnished by some engineer, or perhaps some architect on a large building, who had his own particular ideas as to the size of stone he required.

The company with which I am connected makes at the present time about eight sizes. We modify those a little. We take out certain screens and put in others for specific work, on demand, but we do it against our will, and under protest. At the same time, we are compelled to do it. A few years ago the engineer of one of the counties in Michigan adopted a standard size for macadam smaller than that which we had been making. We were obliged to put in a screen with a 3-in. opening, which we had never used before, because the specifications demanded 3-in. stone, and when we shipped the 4-in. stone it was rejected.

I learned from one of the members of the committee, who operates in our district, something I had not known before. He told me that recently they were compelled to furnish a 6-in. macadam, because some engineer said the size of the stone for his macadam base must be 6 in.

The question is so large and so important to all of us that it seems to me we must start it with a campaign of education. It would be folly for this association to adopt standard sizes of stone and have the American Society for Testing Materials adopt something else. It would be folly for us to adopt standards sizes, and have the highway engineer say we were all wrong, and that we must make such and such other sizes.

The question is one which must be carefully studied, and upon which time must be taken before we arrive at any definite conclusion.

Recently there has been considerable change of policy in regard to screens. Our own company sticks to the punched screens, and the stone passes through a ring of such and such a size, and is held on a ring of another size. The highway department of the state of Illinois, in its last specifications says the stone must be held on a square mesh screen of such and such a size, or pass through a square mesh screen of such a size. Some of the quarries in our district are using some square mesh screens. I think the Lehigh Stone Co. is using them. I do not know how far any of you operators have gone into it, but it is something I have considered seriously, and it is something we are all going to consider seriously. Most of us are short on screen capacity, and I am told we can increase our screen capacity without our present sizes of screens being changed, if we change from the circular openings to the square openings. I am told the increased capacity is from 20% to 25%, and that we will get a better screened stone, with the same equipment and without changing the lengths or diameters of our screens. From this point of view alone the subject is well worthy of serious consideration.

Most of us are up against the same problem of getting our stone properly screened without increasing our screen room or without increasing the size of our buildings.

Use of Roadside Material in Ontario

S. L. SQUIRE, deputy minister of the department of public roads, Province of Ontario, said:

In conserving our road building material we have seen fit as a province to use wayside materials, not that we have not been very careful about the quality. If my friend Mr. Doolittle were here, I think I should thank him and I think it would be quite proper for me to thank him publicly for the very great service he has rendered our Province during the past year in producing a pamphlet showing that nothing but commercial material should be used in connection with our road construction. In doing so he has shown we can get a quality of road by using the commercial material which was not likely to be gotten if we used wayside material, but we have been doubly careful in connection with the kind of wayside material we use. We have washed the gravel, when necessary. We have graded our sands. We have made laboratory tests all the way through, and I am satisfied we have produced for our people that which Mr. Everett has desired for his people; a more economical and satisfactory road, even if we have not used altogether the commercial material which is, of course, of interest to this association.

Washing Stone?

C. E. GLASSON, Columbia Quarry Co., St. Louis, Mo., read a paper on "When and How to Wash Stone," in which the following points were made:

Progressive quarry operators deserve much credit also for the advance made in the perfection of concrete. They, too, do wonders in the way of preparation, both as to mixture and removal of degradation from their product, realizing that in order to meet the engineers specifiations well graded and clean stone is necessary.

The average well regulated crushing plant will make stone of proper mixture and well screened, but in no case that we know, is stone produced without a considerable amount of dirt coating, and it seems quite impossible to remove this coating by screening.

Whether or not this dust coating interferes with the binding of cement and stone, is somewhat in question, but in our opinion, the strength of concrete can only be determined by the strength of the binder, and the contact between the binder and coarse aggregate.

If this be true, is it not reasonable to assume that with stone covered with dust, especially if the stone be of a kind that breaks in a way to expose innumerable craterlike surfaces, each little pit filled with dust; a close contact between the stone and binder cannot be had?

We know that the closely grained dust is in a sense waterproof, and for that reason will prevent the moisture in the binder from penetrating the surface of stone, a condition very essential to a thorough bond, and possible only with clean stone, and other more porous coarse aggregates.

With this dust rinsed off and the surface of stone rendered clean, the moisture containing cement will be absorbed by the stone itself, and the bond made deep under as well as on the rough surface making bond, a condition not possible with aggregates comparatively impervious to moisture even though such aggregates be thoroughly washed.

Without rinsing the stone as described, the dust might become removed in part, and in the process of mixing concrete, that portion removed will then become a part of the cement binder, and will have reduced the strength of same in proportion to the dust thus removed.

To compensate for this, more cement should be added for concrete of equal strength at additional expense.

We are so firmly convinced that washed stone will be demanded by critical engineers and others in the near future, and that washed stone of good quality will automatically displace other rough aggregate if permanence and strength are required, that plans are already made for an installation of unit rinsers, each size stone for itself, in our new crushing plant.

The dust resulting from the process of rinsing can be easily carried to settling ponds and reclaimed if desired, after it dries naturally, or at once, by a drying system and bagged, being fine in structure and of good quality, a ready market at a good price awaits such a product.

The rinsing process should be carried on after the stone has been reduced, in our opinion. This would require the least water and apparatus.

The advantages of washing stone are numerous and we believe, the gradual more exacting requirements of engineers and competition of washed aggregates, and further, as an economical measure, will require operators of crushing plants to wash stone somewhere in the process of production.

To our knowledge, many thousand tons of screenings ranging in size from 1 in. and

down, are in storage piles throughout the country, and considerable loss, the loss being absorbed by the stone sold.

By properly washing as a regular adjunct to the crushing operation, stone formerly wasted could be sold at a good price, thereby reducing the unit cost per ton of stone produced, and saving the entire costing of stoning, which in some cases represents a large amount of money for labor, to say nothing of the yard-room required for the purpose.

We are of the opinion washed stone of proper characteristics will make all other rough aggregates secondary to it.

For chemical use nothing will remove objectionable matter from stone as well as washing.

The inroads by concrete on structural steel, brick, and stone cannot be maintained without inciting propaganda on the part of the producers of the competitive material, and it therefore behooves us to closely regard standardization in size of aggregates, and that these aggregates be furnished as clean and free from dust or other degradation as possible, in order that we continue to merit the widespread approval of users.

Discussion of Stone Washing

J. W. STULL, Liberty Lime and Stone Co., Rocky Point, Va., said:

I have not had any actual experience in the washing of crushed stone aggregate, but I have had in the washing of a preparation of iron ore for furnace work.

It is a most difficult process to undertake, where clay is to be contended with.

Where it is sand, it is not so difficult, but clay is the most serious problem the crushed stone industry has to go through. It will tax everybody's mind to bring about a process sufficiently uniform and sufficiently effective to be satisfactory.

I think it behooves the members of this organization to confer, as far as possible, with the engineers who have this in charge, and see if there is not some other way we can get by without having to go to the expense of installing washing plants that will cost us hundreds of thousands of dollars, from which we will not get any results, in so far as increasing the selling price of our products.

Salesmanship in Marketing Crushed Stone

One whole session of the convention was devoted to a salesman's conference, but unfortunately a large part of the time thus assigned was taken up by a discussion of the road laws of a few of the states. There were, however, many good suggestions for the crushed-stone salesmen not only in this session, but in all of them. We have tried to gather all these here under the foregoing heading.

Stone for Rural Driveways

MAJ. THERON M. RIPLEY, division engineer, New York State Department of Public Works, Buffalo, N. Y., said:

There were in 1920, 11,212,654 rural dwellings in the United States—20,692,204 in all.

This year there will be 20,000,000 motor vehicles licensed. It is conservative to say that one-half of this number will be in the rural community class.

We are all familiar with what the motor vehicle has done in the past. Can we not predicate some of its influences in the near future?

To come off a paved street or road onto a soft muddy drive with an automobile is neither pleasant nor economical.

With the foregoing premises, let us make a deduction for an educational selling campaign, viz., one-half the total number of rural dwellings are occupied by automobile owners, who have not an improved entrance to their garage or barn; the average distance from highway to garage, including turning area near garage, equals one hundred feet and the width to be improved, equals nine feet.

Now, with your pencil, you can easily arrive at the tonnage necessary to put these drives in passable condition—if we assume a depth of No. 1 and No. 2 stone as shallow 3 in., it would mean 10 tons per drive or 56,606,327 tons.

Can you not go out and get this business? If you can clean up one or two back yards in a neighborhood, thereby giving mother a chance to feed the chickens without putting on her rubber boots, the women will see that the balance is cleaned up. I know the rural community likes crushed stone, because I have many evidences of its use in small quantities along the private drives adjacent to our improved roads. Many of these users we had to curb, in their zeal for better driveways, in order to have material for doing our state work.

Where one ton is stolen from us, I want you to sell five and thereby we both will benefit and your customer can keep or regain his self-respect.

There is no reason why the use of broken stone can not become as popular and as necessary for a properly equipped home as an automobile or a carpet sweeper. Its proper use would keep a lot of dirt out of the house, off the machine and prolong the life of all the furnishings.

Help the Helpless Contractor

MAJ. W. M. ACHESON, division engineer, New State Department of Public Works, Syracuse, N. Y., said:

Now, let me say a word to you about salesmanship. There is no individual who needs as much help as the contractor, and there is no individual in highway work today who is as helpless as he is. He signs his name on the dotted line of a contract in which he practically has no redress—the proportion is only 30% in his favor, and 70% in favor of the state. This has only been brought about by abuses and by the ingenuity of engineers to see they shall have the whole say in their hands. Salesmen should make it a very important part of their business to see that contractors shall receive the greatest co-operation and consideration from the material men. After the contractor has signed his name on the dotted line it should not be a matter of the salesman simply saying: "Well, I have John Johnston's name on the dotted line. To hell with him. The boss will make us all feel pretty good," and then not seeing the contractor again until he gets another contract. If he is treated in this way, the next time he gets a contract he has some resentment against the company, perhaps because his deliveries had not been met, or for some other reason. It should not be a matter of looking at it from the point of view that every time a complaint is made you should adopt the attitude of refuting what was said.

I have kept close data on some of our work, (and one of our modern contractors who has kept excellent cost data agrees with the figures) and we find that in the carrying on of the construction of a concrete road every minute's delay at the mixer means $1.50. One minute's delay of a 3¼-ton truck is equivalent to 6 cents. These figures can be easily verified.

This is where the salesman enters the proposition. He should circulate among his customers, find out how much material they need, keep them supplied, straighten them out with the railroads, and see their rates are proper. The contractor on a job has no time to do this, and if he has the time it sometimes happens he has not the intelligence, or he may lack the inclination. Failure on any one of those points may mean the unsuccessful prosecution of his work, in which event he blames the man who has let him alone, and feels that man is absolutely responsible for the failure.

Give Real Service

FRED C. MURPHY, secretary, Brownell Improvement Co., Chicago, Ill., said:

As far as telling any of you how to market crushed stone, I will not attempt it, because you know that if some fellow's freight rate is 88 cents and yours is $1.06, he will show you how to sell it. It is a matter of freight rate, and if it is on a close margin, it is up to you.

I will say this about the Brownell company: We are a fairly large company, and I find many times, when contractors have been in the market for stone I realized there was not much chance to sell them, but I did not let that interfere with any help that I could give them.

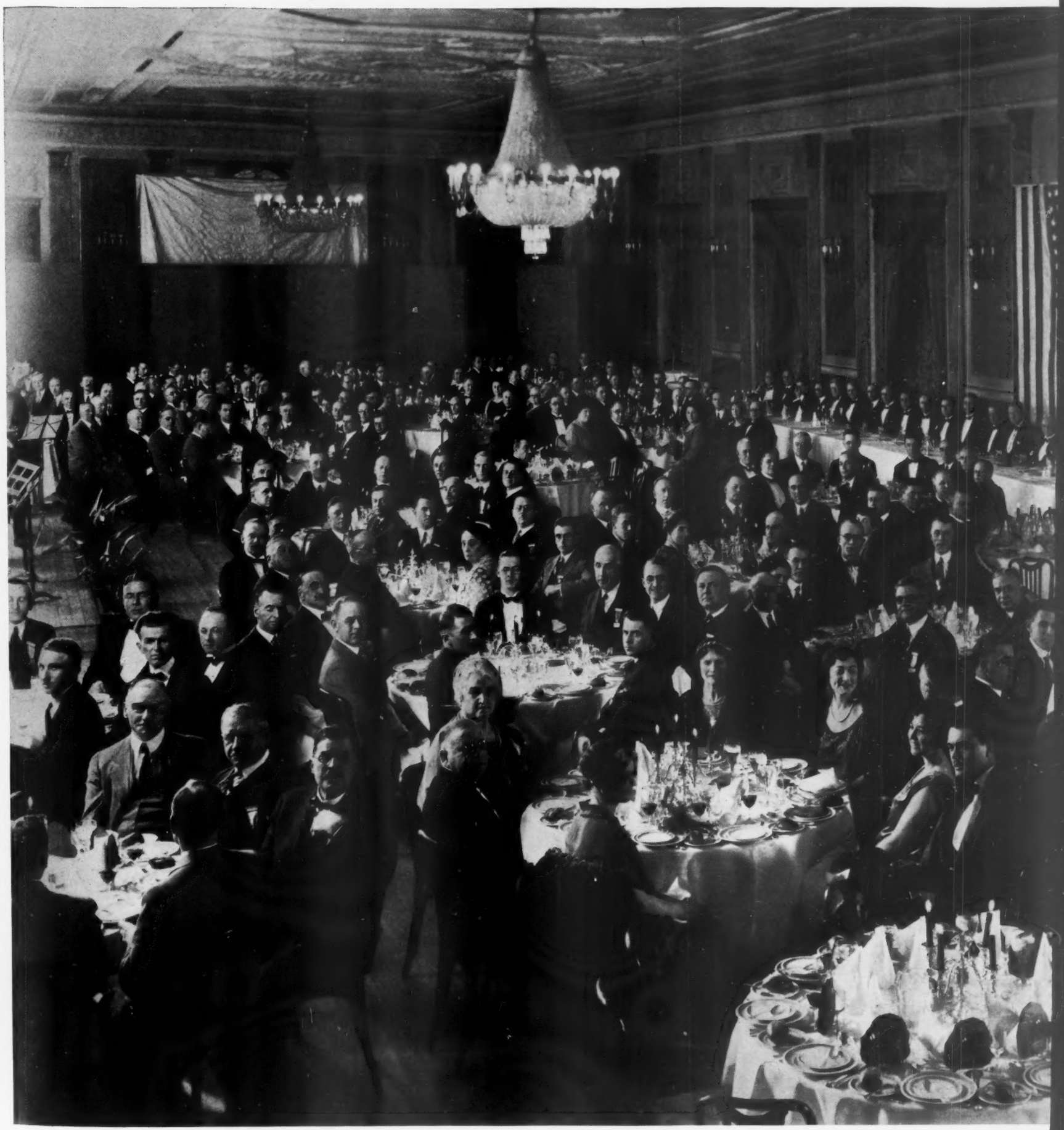
I will cite one case: A man who is known as "hard-boiled" came and asked me if I could do so and so, and I did it, not expecting to get his work, but simply a courtesy, and, by looking after his interests, when I knew I would get nothing, I eventually sold him one of the largest jobs we ever had. He said I want you to help me out on this, and if you do I will give you a job. He could have got the material from others cheaper, and just as good.

After we get a job, it has been our policy to follow it up and give them *service*. I believe that developing fellows like that is better than all the salesmanship. In this way you will line up five, six, seven, eight or nine contractors, and when you reach them you have a good chance of getting their work.

That is about all I can say about salesmanship. You know that it is a question of freight. We practice that policy and try to win the people over to us. A fellow might have a job some place, and you might have a little pull with a railroad, or whatever it is—even if you don't get the order, help him, and he will come back to you because you have helped him when you did not expect anything from him. That has happened to me on many occasions.

H. H. BRANDON, Ohio Marble Co., Piqua, Ohio, said:

To me, Mr. Murphy has left with us two outstanding thoughts, first, and probably



Banquet of the National Crushed Stone Association, assembled at Montreal, Que., January 20, 1926, for the ninth annua
Canadian National Rys., guest of honor; C. M. Doolittle, president,

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h annual convention; Sir Henry Thornton, K. B. E., president and chairman of the board of directors, resident, Canada Crushed Stone Co., Ltd., toastmaster

most outstanding, is that what he is really selling is *service*, and I think we should give some thought to that idea of giving real service, putting the material to him in such a manner as will inconvenience him the least, giving him the best quality, and in the way he wants.

Another things he brought out, which is very delightful to me, was another indication of the proof of the great need we have of the services of Mr. Boyd and Mr. Goldbeck.

Get Co-operation From Operating Men

I. W. WORTMAN, Morris County Crushed Stone Co., Morristown, N. J., said:

One feature, which I will take the opportunity to stress right here, is that we have not been selling *service* to the fullest extent.

Our company has prided itself on service, for years. We give as good service as the average, but we have not been giving all the service it demanded and, I think, that is a natural development of the industry.

A man would go into the crushed-stone business, build a plant, open a quarry and run it; then he would get an order, and when he had that order completed he started out to find another. As long as he had a certain amount of business, his main thought was directed towards production of material; the cheaper he could produce, the better off he was, until there was developed a condition in many quarries where the only thing was for a salesman to go out and sell what they had, when they had it.

This should be reversed. We have to give the customer what he wants, when he wants it and in the manner he wants it.

That is the reason we have such strong competition today. Other people have realized that situation and have given service that many quarries would not give.

The people connected with the selling department must have the best co-operation from the plants; not to sneak something out because it is cheap and convenient to put out.

The plant does not hear the kicks; it is the man who sells who gets them, and that man cannot reach the head of the organization every time he hears the kicks.

I believe there are a lot of side lines or by-products that can be developed for this business. I might mention that we, in New Jersey, have been bothered with dust on stone. We have had it suggested that we wash our product. We have lately installed a dust-collecting outfit. We did it to make our product better, with the result that we have been able to bag this material and sell it to the chemical trade. It is not a large market, but it will be developed.

All these things are going to help build up tonnage.

Giving Service Through Service Bins

ALBERT L. WORTHEN, vice-president and general manager, Connecticut Quarries Co., New Haven, Conn., said:

I am a production man and I came here to learn something about sales, because it got to a point in production where the sales end was not taking care of what the plant produced.

We have a service plant which we have established in a territory where we had never been able to get business, because of the competition with which we were not in a position to compete.

We are rail shippers, and this territory was covered by water delivery.

Now, if you are operators where you have rail and water possibilities, you realize that it is pretty hard for rail to compete with water, with the great difference in the cost of transportation.

We had the idea of trying to overcome that differential by service to the customer.

We established a plant outside of New York City and put in a number of bins to hold all sizes of stone, starting with a thousand ton capacity for five sizes. The idea being that if a man wanted a few tons of stone, this service plant was there. He might, perhaps, pay a little more per ton for the material, but it was convenient.

We also had the idea that if we could get a part of the business which the water-delivery people got, we might be able to have enough to live on.

We did not know how it was going to come out. You all know that, in water-delivery, if they bring in a barge there is six to eight hundred yards. A contractor wanting a few tons is not interested in that, and there was no means in that territory for a consumer to go and get any size he wanted.

We opened up this plant, and we have been very successful. It is a new proposition.

The people we are competing with—some of them may be in this room—but I will say that we went in there with the idea of a certain tonnage that might be satisfactory with this investment—I don't mind telling you what the investment was—it was about $25,000.

The first year we did more than the tonnage we expected, and then we doubled that tonnage, and we did not compete in price for any of the business. We established a price per ton for the stone, giving the quarry our best price, adding the freight and adding an amount covering the bin charge, and put this price out in the territory and advertised it, and any business we have got, we have not competed for; we did not cut prices.

The business the other fellows got, they went out after. They thought we were going to compete and they made a small cut.

We did not go after the large business. We put that in with the idea of service and convenience; anybody can go there and get the stone at any time. We carry all sizes, and it has been a very successful proposition. We intend to put in a second one this year.

A MEMBER: What is your freight rate from the plant to the service station?

MR. WORTHEN: 85 cents.

A MEMBER: The water rate would be about 25 cents?

MR. WORTHEN: Just about.

How Research Can Help Salesmen

A. T. GOLDBECK contributed the following thoughts on selling:

Undeniably the most effective sales arguments are those which are founded upon established facts presented in logical sequence and in a simple, readily understandable manner. You, who have to do with the sale of crushed stone, are dealing with a class of men who, of necessity and by habit, are extremely practical. They are quick to grasp the significance of facts and eager to make use of all facts which will result advantageously to them.

Fundamentally all contractors are in business for profit, and they are conducting their various dealings with that particular end in view, but most of them intend to remain in business a long time, and their practical bent tells them that a name for good work carried out expeditiously and free from trouble due to the use of poor materials or poor workmanship is a decided asset. Moreover, many of them take a decided pride in a good job well done. Engineers generally are anxious to pick up any information possible, from all sources, which will enable them to obtain better work, less expensive work, or to select road types which will be more suitable for their traffic conditions, their subgrade or their climate. So give them facts, by all means.

A good salesman should know everything there is to be known about his product, and that is not all, for he must be in a position to advise with those who are concerned with its use. Doesn't it stand to reason that you will be given a mighty warm welcome if you can go into an engineering or contracting office with some new idea you have picked up which might be of real help to your client and especially will you get more and more recognition if you are able to leave with him a new kick every time you call. Every once in a while he will be able to make use of the bit of knowledge you left with him, and then your presence will surely be looked for and your advice will be sought. In other words, you have established some very real good will and a reputation for sound, useful knowledge about your material.

The business of the bureau of engineering, so far as the sales forces of the industry are concerned, is to supply you with such facts about your materials as might be brought to light through past researches, through experience, or through the results of researches which will be made in the future.

To Issue Technical Publications

As often as possible the bureau will issue technical publications dealing with some phase of the use of crushed stone, and at times these articles will contain suggestions as to proposed new designs of roads aimed at the production of more lasting and more suitable roads than those built with our present designs. You, in the sales departments, can help your bureau of engineering gain the needed facts by preaching the gospel of research and investigation on the part of highway departments—research in the field using new designs which will be proposed by your bureau of engineering.

There are many of you in the sales force, and you are scattered over the country and come into personal contact with a great many engineers. You can bring the thoughts of your bureau of engineering directly to the attention of those engineers. If we propose a new design which we think will make a better road, get these engineers to give it a trial. Tell them of the policy to which your bureau is rigidly adhering, that of true helpfulness, not only to crushed stone producers, but also to the users. Tell them your bureau will propose no new design or no specifications or standards unless, above all else, the users will be benefited thereby. In cases where the design or standards proposed are problematical this will be clearly stated and the matter put forth as somehting which we think merits a trial.

As an illustration of the above thought, I am writing an article for a coming issue of the *Journal* proposing some revised designs in macadam road construction which appeal to me as having possibilities in the improvement of macadam for carrying our

present day traffic. These designs include features not found in our present macadam; for instance, the provision of means for increasing the vertical and lateral strength at the edges of the road, means for maintaining the full effective thickness of the stone layer by the prevention of mud intrusion from below, means for providing better drainage for the subgrade by the use of an unusual subgrade crown and the use of a "blanket layer" of screenings clear to the ditches. These are things you can advocate as things worthy of a fair trial for they all should make for better macadam construction. Bring this information to the attention of engineers and emphasize our really sincere efforts to help them as well as ourselves.

Standards for Various Types of Roads to Be Established

Then, as time goes on, we should be able to get out standards in separate form covering what we think is good construction for the different types of roads containing crushed stone. You will have these standards available for distribution to engineers and contractors, and that will be service to them which they will appreciate.

We, as an industry, should be fully informed about the use of our material and we should be so downright fair in the presentation of that knowledge in the form of standards or designs that we will be looked up to as a source of authentic information on crushed stone. Many engineers will appreciate the help which they will get from our standards in the writing of their specifications or the drafting of their designs and surely that will help our industry and perhaps ease your paths a little.

I have in mind, too, that engineering facts will help you if such facts tell the contractor or the engineer in what respect your material is advantageous for given types of construction. As I have had occasion to say to some of you, I most emphatically do not believe in using these facts to disparage other aggregates, rather let them be used to exalt crushed stone. You are supposed to be authorities on the merits of crushed stone and your word on that material will carry more weight than when you talk about your competitor's material. But undoubtedly I am preaching on a subject about which you know far more than I. Much remains to be found out about the relative merits of the different aggregates and you must be a little patient if these facts come to you more slowly than you would like them. Remember, they have to be dug out painfully by methods of research, and research cannot be done over night, especially with concrete. Most of our facts on concrete have to do either with resistance to compression or cross-breaking under a load applied once. We should be able to say something very definite about the influence of the coarse aggregate on concrete when subjected to repeated loads, to repeated impacts, to alternate freezing and thawing, and to alternate wetting and drying. Likewise, we should know something more about the growth of tensile strength of concrete from the day it is placed.

General observation seems to indicate that stone concrete has a remarkable resistance to cracking during long periods of exposure. This is brought out in the report by C. A. Hogentogler in connection with his investigations of reinforcing steel. We should be able to explain this apparent fact by tests such as I have just suggested. A special survey by the National Research Council on the service behavior of concrete roads containing different aggregates no doubt would show some very interesting facts as to the influence of the coarse aggregates.

The standardizing of commercial sizes of crushed stone, an engineering matter in which we are interested, should help the sales forces, for when this is brought about, the fewer sizes resulting will mean simplification of production and less confusion because of a uniform nomenclature which everyone will use. Your bureau of engineering is actively concerned with this subject right now.

The discovery of new uses for stone products and the making useful of products now wasted are obvious ways in which engineering can assist sales. Much can be done along this line for stone dust and stone screenings.

Summary of How the Bureau Will Help Sell Stone

To sum up the matter, then, engineering can help sales:

1. By supplying facts in the form of technical articles and standards leading to the proper and more successful use of crushed stone.
2. By suggesting improvements in road design looking toward greater resistance to traffic and therefore greater popularity of the improved type.
3. By discovering uses for waste products, thereby creating larger markets.
4. By supplying facts on the advantages of crushed stone as these facts become definitely established.
5. By simplifying commercial sizes, thus leading to economies and better understanding between producer and consumer.

Your bureau of engineering wishes earnestly to co-operate with all of you and help you as much as possible in your problems. In turn, I ask your co-operation in helping me initiate some of the field researches which I shall propose from time to time, and in supplying me with the locations of such investigations, so that I may watch the results. I feel that as time shows the day we shall be able to work together to very good advantage in a spirit of mutual helpfulness.

Apply the Golden Rule in Competition

CORNELIUS D. GARRETSON, in his speech following the banquet, gave some excellent pointers on selling. He said there was inclined to be too much an idea that business is business; fight for it; instead "the golden rule" was a practicable rule in business. The trouble is competitors will not face the issue; yet unethical things done in a business way are invariably costly in the end. Fear of competitors exacts an enormous toll; producers cut prices because they are *afraid* they will lose business. Salesmen too often go out with the idea of selling *under* the other fellow, instead of realizing that they are ambassadors of their company, putting before customers a policy of a fair price and service to all.

C. L. VAN VOORHIS, engineer of the Ohio Crushed Stone Association, Columbus, Ohio, said:

I would like you gentlemen to carry home this thought: Get closer to your engineers. Get closer to those engineers in authority. Ask them to build a better road than they have ever built before. If you are building a crushed stone road, or a macadam road, ask them to give that road the same supervision and the same inspection all the way through. Ask them to give the subgrade the same supervision and the same inspection as they give to the so-called permanent types. When you reach that point you have reached the point of building a better road.

I know it is true that in some sections of the country the macadam road is becoming somewhat unpopular, due to the fact that they do not take it seriously, and this applies to the engineers, and sometimes to the promoters. A good smooth riding surface, once finished, and a road well and properly built, will do more to sell the idea of stone roads or any other roads than anything else you can do.

Let me ask you once more to get closer to your engineers and to the others in authority.

Problems of Operation

Operation did not come in for its full share of discussion, but there was a discussion of accident prevention and an excellent paper on fire hazards which form the nucleus of what follows:

Accident Prevention

E. E. EVANS, president, the White House Stone Co., Toledo, Ohio, chairman of the quarry section of the National Safety Council, after sketching the growth of the National Crushed Stone Association, said:

Perhaps a very brief history of those results which brought about the quarry group in the National Safety Council would interest you at this time. Our local Toledo Safety Council, through its secretary, approached several of us who are engaged in quarrying, and suggested that a group of crushed stone men interested in safeguarding the employee be formed, and, if possible, organized. A few of us gathered in Toledo. At the meeting were present some of the gypsum operators, and a representative of the Sandusky Portland Cement Co. We discussed the situation, and the result was a temporary organization, as it were, was formed, and officers were elected. We arranged for a larger meeting, which was attended by a number of stone producers.

The result of that meeting reached the ears of the officers of the National Safety Council, and provision was made for the establishment of a quarry section, at the last congress, held in Cleveland last September. Those of you who did not attend that congress certainly missed something very essential in stone producing. More than 8000 delegates attended the conference—representatives from the steel industry, and from the automobile manufacturers. I am sorry to say there were but few representing the stone industry. The fact of the matter is we are still young in the development of our quarry section.

I am supposed to tell you what the quarry section of the National Safety Council proposes doing for you, providing you become affiliated with that organization. I am sure it would be a waste of your time if I were

to attempt to enumerate the essential things that should be carried on in a crushed stone operation, because you are more familiar with them than I am. Many of us work only part of the time on safety measures, and I believe we are more exercised with reference to the formation of safety methods in the operating of our plants directly an accident happens. We take the matter up with our superintendent, and say to him: "This must stop." Then we go on another vacation until another accident happens.

The stone industry—and I speak particularly with reference to Ohio—are paying a higher rate today on their pay-roll than is the soft coal or bituminous operation, and I believe you will agree with me that the mining of soft coal is more hazardous than the operating of a stone plant. The solution of the question is this: That we as stone producers must more seriously consider the human element which enters into our operation. The saving which will be effected because of safeguarding the employee will be reflected in our balance sheet.

At times we seem to forget that we have a duty and an obligation to the employee. Our superintendent or foreman employs them individually. The contract is made by which the man agrees to sell his services, for which we agree to pay, and the state demands that we give him safe employment. I know of one or two plants in Ohio in which safety standards have been adopted and where the work is carried on more effectively, so much so that efficiency is materially increased—and where you have increased efficiency it means economy in operation. This program they have carried on has resulted in this one complaint, which I know is of importance to you men who are operating. The men have become so imbued with the idea of protecting themselves first, and watching the other fellow to see that he does not meet with an accident, that the idea is carried out through actual operation of machinery and equipment, with the result that the equipment maintenance cost has been materially reduced.

I might tell you of some of the other things which were brought up in Cleveland, but, as I said before, you are thoroughly familiar with what is necessary in the operation of your plants.

A little plan which I think will work very effectively is this: You and I visit our plants and see the same thing each day. There may be something seriously wrong in the placement of our equipment, or in the protecting of it so that the employee will not meet with any danger, but we see it so often that it is not noticeable to us until someone from outside calls our attention to it. Would it not be a good idea, now that we are a co-operative body of men, for one competitor to visit the other fellow's plant and check up with him, so that changes which are not noticeable to the one will be suggested by the other.

Safety Trophy

N. S. GREENSFELDER, advertising manager of the Hercules Powder Co., Wilmington, Del., and editor of the *Explosives Engineer*, explained the competition in the quarry industry for the *Explosives Engineer's* safety trophy. Nearly 300 mines and quarries entered the contest in 1925. The accident reports are now being studied by the Safety Bureau of the U. S. Bureau of Mines, and will be announced as soon as possible after the close of the year. The formal presentation of the trophies will take place at the Bureau's Annual First Aid and Rescue Meeting.

Fire Prevention and Insurance

D. C. SOUDER, insurance manager, the France Stone Co., Toledo, Ohio, read an excellent paper entitled, "The Fire Hazard at Quarry Plants and How to Carry It." This paper follows:

I shall deal with the structural makeup of these plants. (2) The operation and fire hazard in connection therewith. (3) The fire protection afforded the average plant.

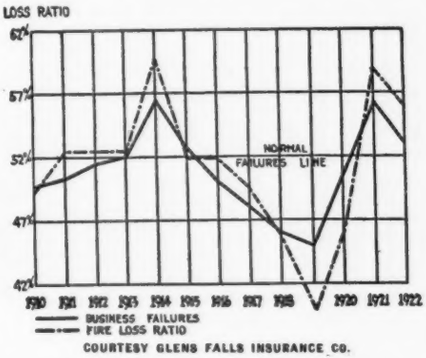
The crusher plants are largely tall frame structures of so-called "balloon-type construction." Fires originating therein will naturally spread at a very rapid rate due to the combustible materials used in construction and the numerous vertical openings, such as stairways, elevator openings and belt holes which go from floor to floor. The vertical openings act as flues and aid in the rapid spread of fire. Shingle roofs are dangerous and should not be countenanced under any condition, no roof at all is better than a shingle roof.

The fire hazards are principally those of power, such as steam, electricity, gas, and fuel oil. Power arrangements should be confined to incombustible or fire resistive structures cut off in proper manner from the crusher building and other buildings. If power buildings are of combustible construction, such as brick with wooden roofs, they should be well detached from the crusher plant with a minimum distance of 40 ft.

Electric power, I feel, is the safest form of power in a plant of this kind, if properly installed and proper supervision given to motors. All wiring should be in conduit due to the possibility of the breakage of insulators and barking of wire insulation and derangement of wires caused by falling or flying rocks, falling or leaning tools, addition or removal of boards or timbers to the building and other similar causes.

In steam power plants, boilers should be set on concrete floors with ample lateral and vertical clearance to combustible walls and roofs. Metal stacks, where passing through combustible roofs, should have 18 in. clearance.

Where a gas engine is used, magneto or battery ignition should be used rather than hot tube ignition which still exists in some plants. The gas regulator device should be of a cast iron type with a rubber bag inside and should be vented to the outside. The water sealed tin can regulator is not a very satisfactory device due to its flimsy construction and the natural tendency to corrode.



Business failures and fire losses compared

In case of oil engines, the main supply of oil should be buried outside and pumped to engine with shut-off valves provided in feed lines at engine, pump, and at tank. All piping should drain back to the tank. The Underwriters' requirements, as I now recall them, make provisions for a relief valve to by-pass the oil back to the tank in event of a rupture of the line.

Elevator legs in the crusher plant should preferably be of incombustible material—that is, metal. Bearings should set on incombustible blocks rather than wooden ones which are likely to become oil soaked and a great source of danger if hot bearings should occur.

Approved waste cans should be provided for oily waste and rags. One man in your plant should be assigned to the duties of oiling machinery and motors. Motors, whether of a.c. or d.c. type, should be blown out frequently—not only from the standpoint of fire hazard, but also from the standpoint of economy.

Locomotive sparks can always be considered a source of danger, especially from plant-owned engines which are usually called upon to carry loads beyond their capacity, and in addition, combustion is generally poor which results in excessive sparking. Smoking by employes should not be tolerated under any conditions.

I wish, at this particular point, to call your attention to the fact that the protection of your fire hazards should not be considered in a passive light—but, one that is vital to your interests. The proper supervision of your plant is essential in order to reduce fire losses to a minimum, which, of course, means keeping your production at a maximum point. No honest man ever benefited by a fire. In fact, the best he can get is a draw.

I now wish to say a few words about the fire protection feature. Most of the plants are isolated from public fire protection and, in consequence, it is necessary to depend on private fire protection devices. By far, the majority of fires start on a small scale and if proper devices are provided to combat these conditions, fires should readily be controlled if discovered in an early stage.

The 2½-gal. approved extinguisher is a very desirable fire extinguishing feature. However, if sufficient quantities of water are available, a stand pipe system with hose at each floor level can be considered desirable if a fire pump of adequate size is installed to convey the water at a proper pressure. There are, however, drawbacks to the latter system as I see it and that is the fact that hose must be given very careful attention so it does not deteriorate to such an extent as to make valueless in event of a fire. Also, some delay might be occasioned in getting water due to the fact that water cannot be allowed in the pipes during winter months, due to the possibility of a freeze-up. Altogether, the chemical extinguishers are the most economical and probably the most practical.

Before closing, I want to give you a few facts that have come to my attention which, I am sure, will interest you. During a 50-year period from 1875 to 1925, the property loss in this country has increased from $78,000,000 per annum to over $500,000,000. This is a sad state of affairs when you consider that this property can never be replaced and I am sure that you can visualize what a terrific drain this will prove to be if fire losses are not greatly reduced in the future. It is not

possible for even as rich a country as this is to lose physical property to the extent that we have done and not suffer at some future date. Even in our business, I find that loss ratios are excessive. I have just learned that one of the large fire insurance companies in this country has paid out approximately $1.09 for every $1.00 they have taken in on the insurance of stone crusher plants.

Fire has a far-reaching effect. I find that 43% of the plants or business enterprises that are destroyed by fire are never rebuilt. Fourteen per cent lose from 30 to 67% of their credit standing.

In conclusion, gentlemen, I again wish to emphasize that better housekeeping methods must be employed in our plants and better supervision shown if we are going to reduce fire losses and conserve the natural resources of this country.

Discussion of Fire Insurance

JOHN RICE, president, General Crushed Stone Co., Easton, Penn., said:

We have been operating about 26 years, during which time we have had two fires. One cost us about $10,000 or $15,000, and the other cost us about $150,000. The latter fire occurred two years ago, at Akron. The plant was truck by lightning. It was a frame construction, and it burned down in the course of a few hours. Nothing in the way of protective measures could have prevented it.

As a rule we do not house in our plants, both as a matter of fire protection and also with the idea of letting the dust blow away rather than gather on the machinery. We do not carry any insurance except on such plants as we have bought subject to mortgage in which there was an insurance provision. I do not know whether we are ahead or behind on the fact that we have not carried insurance. Insurance against the loss of operation would, of course, be very expensive, and I believe we are just as well off not having carried insurance as if we had done so.

We have at all our plants reasonable fire protection in the way of extinguishers and such water supply as we can obtain. In no instance practically are we situated where we can secure assistance from a fire department.

J. HARRIS LOUCKS, president, Albany Crushed Stone Co., Albany, N. Y.:

I would like to ask Mr. Rice if he is familiar with the rates of insurance in various states, and as to whether there is any difference in the rates on quarry plants in one state as compared with another.

MR. RICE: No. I am not. We really have made very little investigation on those lines.

MR. LOUCKS: It may be of interest to you to know that in the last two and a half years I have been quite active in the insurance problem. Ours is an electrically operated plant, but we were being charged the same rate of insurance practically as all other plants, steam, or whatever they may have been. I took the matter up with the superintendent of insurance of the State of New York, who became very much interested in it. He was finally able to persuade the Board of Underwriters in New York state to reduce our rate 50 cents per $100 less than the generally established rate. In addition to that I took out some insurance in non-board companies, and got a further reduction of 50 cents per $100.

I would like to know the experience of some of the other members along these lines. It might be we could get another 50 cents reduction.

H. E. BAIR, general manager, the France Stone Co., Toledo, Ohio, said:

Our experience has been rather sorrowful. Five of our plants burned down in the last ten years, and they were all large plants, the smallest with a capacity of nearly three-quarters of a million tons a year. Basing ourselves upon the experience gained from our last fire, I think we will never build anything but structural steel fireproof construction, and we hope to have a better record in the next ten years.

Carbon Limestone Co. Experience

FRED O. EARNSHAW, general manager, Carbon Limestone Co., Youngstown, Ohio, said:

I have been associated with the Carbon Limestone Co. for about ten years, in which time we have had four fires, the last one being on September 22 last year. This fire started about two o'clock in the afternoon, and in 50 minutes the plant covering an area of 100x400 ft. was laid flat. This plant was built mostly of timber, with wood sheathing and a paper roof. One corner of the plant was used for the storage of paper bags, and we had probably 300,000 paper bags stored there. The fire originated in this storage. Five minutes after the fire was first noticed it was completely beyond control of all ordinary fire fighting apparatus.

We rebuilt the plant, using sheet iron, metal sheathing, and metal roofs all the way through. Our conveyor sheds are almost fireproof, about the only burning material in them would be the floors. They are equipped with fire doors at either end. Those doors are braced in both directions, and a fire may completely burn the conveyor shed, yet the doors will stand. Like Mr. Bair we hope we will have a better record from now on.

At the time of this fire we had a few 1½-in. and 2-in. lines, and our practice was to carry those lines to the second and third floors, and have 100 or 150 ft. of about 1½-in. hose scattered around. This fire taught us that while we had hundreds of feet of hose we could not get it, and we had to go and borrow hose from distant sections to fight the fire. There was a curtain of fire between ourselves and our hose.

We have now adopted the idea of running a 5-in. line from our main pump supply, and we have standpipes situated 400 to 500 ft. apart. The whole system is installed so that we can connect it up with the city fire department. We have the same thread on the hose, and we carry about 4000 ft. We can reach the corners of all the buildings with from two to four 2½-in. fire hose.

Morris County Crushed Stone Co. Experience

F. W. SCHMIDT, president, Morris County Crushed Stone Co., Morristown, N. J., said:

I can speak of three fires over a period of 30 years. The first was in a small plant, due to spontaneous combustion of coal. The loss was not very large, but the moral is do not have wooden coal bins, particularly for soft coal.

Our second fire occurred about 20 years ago in a plant at Wilmington. Sparks from a passing locomotive landed on the roof. We were outside of fire protection, and the plant burned down in a very short time. No more shingle roofs.

Only two years ago our plant at Bound Brook burned down. The fire was caused by our own stack, and took on the roof. This was not a shingle roof, but a plank roof. We had planks because we were so close to the quarry that we were shooting it every now and then. The season was dry, and water was scarce.

We did not carry much insurance on this plant, because we thought how in the name of the Lord could a plant of that kind burn down, within fire protection. However, it burned down, with the fire department looking at it, and no water in the reservoir, and the city authorities asking us not to use water because the people had to drink it; and they could not use it for putting out a fire. I received a telephone message in the morning, that there was a fire. I was ten miles away at the time, and I supposed that by the time I could arrive the fire would be out, but it was only beginning. The fire department and all our help were there, and could not do a thing because they had no water.

We rebuilt the plant partially reinforced with a fireproof roof, and put in a standpipe. While we have not yet completed our fire protection as we would like, we feel sure it will not burn down again.

MR. RICE: I would like to make a slight correction in my statement, with respect to the loss on our plant. It cost up $150,000 to replace, but I do not suppose the actual destruction was over $40,000 or $50,000, because the plant had been in operation about 15 years.

Sprinkler Protection

MR SCHMIDT: You might be interested in knowing that our insurance carriers are urging us to put in sprinkler systems, and assure us if we will go to the expense, and have an adequate water supply behind the sprinkler system, our rates will be reduced from the present figure of about $3.00 to something under $1.00. Of course, the expense of installing a sprinkler system is very high, and that element, together with the question of deterioration, are points we are now studying.

MR. LOUCKS: The New York Board of Underwriters will not reduce the rate below $1.50, even with the sprinkler system.

MR. SCHMIDT: Our insurance carriers offered to do so.

MR. LOUCKS: And with the sprinkler system we only have protection during seven out of the twelve months in the year.

MR. SCHMIDT: You can have continuous protection by using the dry pipe system. This requires a tank above the highest point of your buildings, and there is an automatic dry pipe system which they tell me works all right in cold weather.

MR. LOUCKS: The interest on the cost of installation of the sprinkler system would buy a lot of insurance even at the excessive rate.

MR. SCHMIDT: That is another point which has occurred to us.

Sprinkler Protection Not Feasible

(A MEMBER FROM OHIO): One of our competitors in Ohio has a dry pipe sprinkler system installed, and they have quite a lot of trouble with it on account of the vibration in the mill. The inspection

bureau inspected the installation, but without any very definite results, and up to the present there are not very many sprinkler companies who will undertake to assure us that vibration will not injure the system. I visited the plant, and we have not been able to convince ourselves that we should install the system.

With regard to the roofing proposition, if you will figure the cost of improved roofs on your old plants, you will find you will save enough money in ten years on your insurance to pay for the new roof, and if you put on a good asbestos type roof it will last you ten years. We have a lot of shingle roofs to tear off and replace, and we will not replace them with shingle.

Ten years ago our average fire rate on all our twenty plants was $2.50 per $100, taking into consideration steam driven plants and electrically driven plants. At the present time, by reason of improved construction and improved methods of protection, we have reduced our fire rate to an average of $1.47, and this taking into account the fact that we have lost five plants in the same period.

We pretty nearly lost one of our plants through a fire which started in a bin over which the locomotive passed. The Bellevue city fire department came out and helped us, and we were able to save the plant. Following that we lined the bins with galvanized iron sheets, running them up about six feet on the sides. We are continuing this in all the plants where we have wood bins. Of course, the newer structure has either steel or concrete bins.

MR. STULL, Liberty Lime and Stone Co.: I have had some experience with the dry pipe sprinkler system in crushing plants, and it was not a success, for the reason that the vibration in the plant was of such a nature that the heads were continually being forced open. We had a great deal of trouble in that respect. The heads would be forced open, and probably a fire alarm would be sent in. Then the whole system had to be drained. Then another trouble would arise, particularly in the winter season, that some of the heads would not drain, and when the pressure was put on they would freeze, and open again. In any plant where the machinery subjects the structure to vibration I would not under any circumstances undertake to install a dry pipe sprinkler system. I think there are many other devices that could be used which will take care of the fire hazards just as well as the dry pipe sprinkler system.

Our plant is electrically operated throughout, and the only fire hazard we have is in connection with the use of driers. When we installed our driers the insurance people told us it would increase our fire hazard 50 cents per $100. I contended that was wrong, and that our driers did not increase the hazard in our plant one cent. We fought them on the question, and were successful in inducing them to admit there was not any additional hazard through the driers, and our rate continues on the basis of $1.75 per $100, with the provision that we keep in the plant water barrels, located at different points easily accessible to the men operating the plant.

Rapid Reconstruction Record

MR. L. R. CARTWRIGHT, president, Mid-west Crushed Stone Co., Indianapolis, Ind., said: We have operated nearly 30 years, with one fire loss, which was caused purely by carelessness. One zero morning a workman tried to thaw out a crusher. Of course we have used our best endeavors to curtail every form of carelessness as best we can.

We have done just as Mr. Bair suggests, reconstructing the plant of concrete, with steel shingle siding and roof.

As to the other plants, we are doing just as was suggested, profiting by our experience and trying to protect our plants in every way we can against fire. We use sheet iron in places where locomotives are likely to start fires. We are doing away with shingle roofs, and so on.

For the benefit of those who may have to rebuild I might say we put up a new plant of structural steel and concrete within six months of the time our fire occurred, and that new plant was in operation with a capacity of 250 tons an hour. We did it by overseeing the whole thing ourselves, and riding everyone who had anything to do with the structure day and night. We only let contracts for certain portions, such as the contract with the General Electric Co., in which we stipulated for delivery of our motors and their installation within four months from the time we made the contract. Our own master mechanic co-ordinated the work, and when we started there were very few "bugs" in the outfit, and the plant went right off 15 hours a day 10 days after it had been in operation.

We could get along with the fire, all right, but the problem of taking care of contracts for the stone we had already contracted for was a serious problem to us, which meant reconstruction and rapid reconstruction was the vital element. We feel we accomplished quite a feat in having our new plant in operation within six months from the day of the fire.

Managing "Humans"

A. B. MACK, assistant general manager, Kelley Island Lime and Transport Co., Cleveland, Ohio, said there was nothing more important than the human element in management. Soundness of policy in handling this element is an essential of good management. Such a policy should be founded on confidence, justice, and truth.

In a large corporation executives must depend largely upon reports, which are not always reliable; yet the employer must have the confidence of his employes for best results, and this confidence can be had and held only by justice. Truth and honesty should be cultivated mutually by employer and employe alike, to help take some of the hazard out of business.

The essence of his scheme was promotion by seniority and demotion only when an incumbent had proved his unfitness for the job. In this way the man is not only given every opportunity to make good, but is himself convinced of his deficiencies if he does not make good.

Controversies are settled by committees appointed by the workmen themselves, and the personnel of these committees are proof that the workmen are capable of judging the right men. Mr. Mack said, in explaining the workings of the plant committees:

There are preferred runs on a railroad —I spent considerable time in the railroad business—the preferred runs are posted, and the oldest man can bid that run in, and he cannot be prevented from taking that run until he has proved himself incapable of handling it.

So far as the working of committees is concerned, our men appoint the committees themselves. We find that the men usually use just as good judgment, in picking men to represent them, as the stockholders do in picking their management, and they are just as careful to pick men they have confidence in. It goes without saying that the management will have the same confidence in their dealings with their men.

These men will meet you half way and talk things over intelligently with you, and they will give and take, if you show them it is to their interests and to the interests of the company to do that.

W. L. SPORBORG, president, Rock-Cut Stone Co., Syracuse, N. Y., said: I would just as soon if you told us how some specific cases work, such as, which man has the day run and which the night run, and if you run double time, etc.

MR. MACK: We have worked our operations almost exclusively in daylight. There is a difference of opinion as to the working of operations 24 hours. We believe that you need to keep your plant tuned up. At the same time, if you only operate seven or eight months in the year, you are going to have idle time that should be productive time, and we try to confine the idle time to the night time. When there is a job open, the man available for that job is given his chance to take it.

A shovel fireman can take his promotion to trainman, and a trainman to shovel engineer. The man himself usually knows whether he is capable of handling the job or not; he has to produce certain results after he gets the job, and if he cannot, it does not take long to show him, or the committee, that he is not the man for the job, and there is no hard feeling or dissatisfaction in sending him back to his other job.

If you run into the question of superannuated employes, these men are usually content to continue in some job which is not for a he-man.

Keeping Tidy

A. L. SCOTT, superintendent, Le Roy, N. Y., plant of the General Crushed Stone Co., in a paper on "The advantages of a tidy plant," said he had always found his men willing to co-operate to make a tidy plant, and that a tidy plant reduced labor turnover, accidents, and costs. He gave a little history of how he got started "dolling up" his plant, beginning with the power house (having been power-plant engineer). A coat of red paint, keeping the yard clean and attractive, and other attention to small details did the trick. Mr. Scott thought the surprising thing about it was that this should attract attention and excite comment. He said there was no reason why a stone plant should look any worse than any other kind of a plant.

Oxy-Acetylene Welding and Cutting

F. E. ROGERS, Air Reduction Sales Co., New York City, gave a talk on the

use of oxygen in oxy-acetylene welding and cutting operations, illustrated with moving pictures; this was followed by any interesting demonstration of some of the properties of liquid oxygen.

There was a very interesting and detailed report of the sub-committee on drilling equipment, of the standardization committee, which will be abstracted in a subsequent issue.

Transportation and Freight Rates

The most important matter in relation to transportation discussed was the report of W. R. Sanborn, of the Lehigh Stone Co., Kankakee, Ill., on the freight-rate hearing at Kansas City. Nearly every one spoke of much improved railway service in 1925. A part of Mr. Sanborn's report follows:

The Interstate Commerce Commission heard the carriers at Chicago in the fall. At that time they would not permit any cross questioning of the carriers and would not permit any evidence from the shippers. They were simply permitting the carriers to state their case without interruption. At a later hearing, also in Chicago, they permitted state organizations, such as state railroad commissions, and different other well organized interests, to present their case. At Kansas City the commission arranged for the organized industries to present their cases.

The only difference between David and Goliath and our association at Kansas City was David was right where he had a nice stockpile of crushed stone, and could pick the size and kind of rock he wanted, and could throw it with some assurance he was going to hit somebody. In Kansas City I had the feeling that it was entirely clay soil around that country, and that there were no rocks or pebbles really worth while to take a shot at Goliath with.

The railroads went into the case beautifully organized. They knew just exactly what they wanted to do, and they knew just exactly how they wanted to do it. They knew exactly the things that would make the best impression upon the Interstate Commerce Commission, and they knew how to dish them out. I have not a word of complaint to make about the way we or our man handled the case, but I feel if the members of this association could once realize the manner in which we tied our counsel's hands when we sent him into that case, we would certainly reform and endeavor to do better next time.

Our counsel, Mr. Birchmore, sent out questionnaires, the answers to which would have been the finest kind of ammunition you ever had a chance to put up to an Interstate Commerce Commission. The statistics of the mineral resources of the country showed there were some 26,000,000 tons of crushed stone produced in the western territory. Mr. Birchmore's questionnaires represented 13,000,000 out of the 26,000,000. That is a proportion of which you may be well proud. Mr. Birchmore issued those questionnaires to all members in the district, and he received six answers within a reasonable time limit. I can well imagine how he felt about that time. Then he sent out a chaser, a different questionnaire, materially shorter than the first one; and he received a dozen or more answers to the first blank, and a fews answers to the second.

Those questionnaires were all sent out on the old plan that the information contained in the answers was to be treated absolutely and entirely as confidential, and that no individual figures were to be divulged. The questions were, of course, fairly pertinent: "What was your output for last year?" "What was your output for the year before last?" "What was your price before the war?" "What is your price now?" "What is your shipping radius?" "What is your rate?"

There was a lot of material which was very personal and very individual, but the information tabulated and set out in cold black and white would have been the finest ammunition anybody could have wanted in this particular case. Still, on account of our old habit of concealing our figures, Mr. Birchmore was compelled to use the information in a general way.

Of course the well-organized carriers were not at all slow in taking advantage of the position. They called attention to the fact that those figures upon which our traffic expert, Mr. Wilson, testified gave them no opportunity to cross question the source of the figures. In other words, if I made the statement that my prices had increased so much, while our freight rates had increased more, the railroads were not in a position to cross question the individual as to just how authentic his information was—and they made the most of it.

The carriers had testified that prices on stone—and, you know the way they put it—had increased out of proportion to the increase in freight rates, that the average cost of crushed stone today was $1.74 a yard, I think—and when that was chased down it was found to be the price at New York. Mr. Birchmore made very good ammunition by proving that prices in New York had nothing to do with prices in the Western part of the country.

The object of the carriers was to show prices had increased out of proportion to the freight rates.

We introduced exhibits, and without bothering you with the details, or giving you too many figures, the net result was that prices of crushed stone in the United States increased 49% from 1917 to 1923 and 1924. The average freight rate increase in the state of Illinois during that time was something like 75%. We had exhibits which showed the increases from specific points to destinations on various railroads, which, in effect, covered the state of Illinois. Mr. Dolese, of the Dolese Brothers Co. (who own a string of quarries extending from Rock Island into Oklahoma, and possibly Texas), testified as a producer having a wide interest in the territory involved. I testified as a producer from Illinois who would be acquainted with the Illinois situation.

We handled the case along three lines: to show our situation as individuals, to show our situation as a state, and to show the situation as an entire group of states represented at the hearing. The exhibit I put in showed our production, and our actual average price per ton in 1917, 1923, and 1924. It also showed a comparison of our prices before and after the war, with the increase in our rates. The increase in our rates has been away out of proportion to the increase in the prices we are getting for our products. This was one of the things unanswered as far as the stone industry was concerned.

Another thing was our shipping radius. The carriers had a very nice exhibit in which they had included all the stone shipped in this country, taking in marble, which comes in at New York and is shipped, say, to San Francisco, if there is any such movement. They averaged it all up, taking in clay products, crushed stone, sand, and gravel, as well as the enameled brick business, or some particular texture of brick manufactured in New York and shipped to Chicago, or Omaha, or anywhere else. The railroad reports showed the shipping radius of stone, sand, brick, and clay was something over 400 miles. The brick people, who were just ahead of us, showed that common brick had a shipping radius so far below 400 miles that this figure was a huge joke, and Mr. Birchmore very wisely had prepared similar figures for the stone industry.

The rough and tumble of it was the shipping radius for crushed stone was about 100 miles, and even less.

Association Accomplishments

PRESIDENT OTHO M. GRAVES said:

It has seemed to me that in making some sort of report to this convention there were two things incumbent upon the presiding officer: in the first place, to inform you officially of those things which you may know informally have transpired during the past year, because this is the foregathering of our membership, which has power to modify, change or veto any action its officers may take between annual meetings: in the second place, I felt it was incumbent upon me to present to you certain suggestions as to our course of action in the year 1926.

I think it is interesting to note, as showing the real life and activity which permeates this association, that the first board of directors' meeting ever held except at convention time occurred in Atlantic City in July last year, and it is particularly gratifying to us all to know that of 33 directors of the association 25 were in attendance at that meeting. When it is remembered our directors extend from California to Texas, to Canada and to New York, I think it is rather a striking example of the interest your directors are taking in the welfare of the association.

The various committees of the association have I think, been unusually active. The Manufacturers Division held its annual meeting in New York in the month of October. This was the largest meeting they ever held, over 40 manufacturers being present, some of them from considerable distances.

Growth in Membership

Our membership committee has been particularly vigorous in its action, and Colonel Tyler will tell you more about what it has done. I could not possibly steal his thunder, because he has rolled up more than I know about it. I think, however, it is not amiss for me to say that just a year ago we had 95 firms as members, and today we

have 169. I think this is a most remarkable growth in one year, and it is due largely to the earnestness with which Colonel Tyler undertook the work and to the seriousness with which he prosecuted it. The individual memberships have more than doubled, growing from 202 to about 440, I think. A mere glance at the treasurer's report will give a reflection of the increased membership.

The report of the treasurer, which will be distributed to you later, will show that our expenses during the year 1925 were several times greater than in any previous year. We spent in 1925 approximately twice as much as we collected in 1924; but, we did not go into debt, and today we have, I think, approximately six times as large a bank balance as we had a year ago. The treasurer and the treasurer's report will speak for themselves later on.

I think the committee on standards deserves very special commendation. This committee has a very difficult and arduous and almost thankless task to perform. However sincere they may be in their efforts and in their consideration, opposition of course arises from some source. Someone does not want to change this, or somebody is opposed to something else.

Standards Committee

The committee is functioning by appointing sub-committees to investigate pieces of equipment which might well be subject to greater standardization than at present exists. The sub-committee on drilling equipment, for instance, is composed not only of active members but of representatives of the manufacturers of well drills and drill tools. This sub-committee held several meetings in Pittsburgh, and has prepared a very interesting, instructive and valuable report in which every operator will unquestionably be interested. It is the sort of report you will be glad to discuss with your quarry superintendents as to the merits of the proposals offered therein. The report of the sub-committee will be made to the main committee this afternoon, and the action to be taken will be determined at that time.

The Federal Specifications Board, the American Society for Testing Materials, the Concrete Institute and the American Committee on Standards have been approached as to a uniform nomenclature of the stone sizes, and, further, as to a revision of the sizes themselves, and considerable discussion has arisen throughout the country and through the Association of the American Highway Officials as to what sizes of stone should be used in highway and building construction generally. Discussions have occurred on the various committees (although in this case we were not on the committees) and the preliminary reports have been submitted to this association for its comment, to be returned with such suggestions as we have to offer. This matter is being handled by another sub-committee of the committee on standards working in very close harmony and conjunction with Mr. Goldbeck.

The cost accounting committee has a very interesting investigation in progress, and I think when it is able definitely to report to you (which will not be at this convention) you will find the report very interesting, very thorough, and of great value. It is not a matter that we should all keep costs alike, but we should not overlook certain phases, and should not place too much weight on one end and too little on another. We should be able to get a general average of cost for corresponding characters of stone. This, of course, represents a very arduous task, but I feel the result has great potentialities for good to all of us.

Appreciation of Ex-Secretary Sandles

The offices of the association were removed from Columbus, and it was to be regretted because of our long affection for our secretary, A. P. Sandles, who, as we all know, so solicitously guarded our infant footsteps. It was not his wish that he go from Columbus to Washington. This necessitated the securing of a new secretary, and at some later stage in these proceedings I hope to have the pleasure of formally introducing to you our new secretary, J. R. Boyd, whom, I have no doubt, you all know personally. Mr. Boyd was an engineer of the United States Bureau of Public Roads. He thinks the thoughts we think. He understands our problems. He talks the language we talk. I believe you will not only all like him, but you will recognize the potentialities for service to the association, and through the assocition to the industry, which lie in the secretary's office located, as it now is, in Washington.

It was a very natural thing, of course, to move our headquarters to Washington after it was decided to establish the bureau of engineering. The board of directors considered the establishment of a bureau of engineering at their meeting in Atlantic City, and referred the ultimate decision as to doing so to the executive committee with instructions to the committee to proceed to the establishment of the bureau of engineering in Washington if our finances, in the judgment of the committee, were such as to warrant the financial obligations we thereby assumed. At the meeting of the executive committee in September, in the city of New York, it was decided our finances had been brought to such a point as to warrant the undertaking of the step, and we therefore proceeded along the lines indicated, with the results which are perfectly familiar to you.

Washington Offices

We have secured rather attractive offices in the Earle building, Washington. This building is in the heart of the center of activity in the city, and that is exactly where I think it should be. We have several rooms. Our secretary, and the director of the bureau, are comfortably housed. We went to some considerable expense in furnishing our offices, because we thought our offices should indicate the dignity which we believe attaches itself to an association of the size and importance of ours. We were somewhat concerned as to the expenditure we made for furniture and furnishings, but almost as manna from heaven the Manufacturers Division gave us $750 to apply towards the furnishing of the offices. At the time when the report is made for the Manufacturers Division I am sure it will be your desire to extend a rising vote of thanks to the manufacturers for the very graceful, practical token of their sympathetic help and assistance.

In establishing the bureau of engineering there was a great deal of discussion as to the purposes and policies of the bureau. It is possible, but hardly probable, some of you may remember that at Cincinnati last year I said in my opinion we should look back into the very far distant past in order to obtain that guide and direction we need to steer a wise course in the future. I called your attention, as I do again today, to the fact that countless ages ago those long tailed reptilian monsters crawled from the receding waters to the drier land in an effort to preserve the life which was rapidly falling from them because of their inability to adapt themselves to the changed conditions at hand, and that the life spark which was in them lived and passed on through channels more worthy of carrying it on and more susceptible of higher development. I told you the civilizations which followed, thousands and thousands of centuries afterwards—Rome, Athens and Greece—those civilizations of former times—all flowered and burst into brilliant bloom until they dropped into quick decay for the same reason, because of their failure to adapt themselves to conditions as they changed, and to the conditions which the world required of them. In other words, that our attention be not concentrated upon ourselves, not what we are going to get, not what we are going to obtain for ourselves, but that we continually hold in our minds the idea that the function of the individual or of the nation is to serve. If we have not this idea continually before us, I think an eternal oblivion awaits us.

Tribute to Drectors

I wish as whole heartedly as I can to give this tribute to the directors, the members of the executive committee and the chairmen of the committees, that I have never seen any group of men work as loyally, as faithfully and with more self-sacrifice for any intangible something as an association is, as have your directors, your executive committee and the committee chairmen during the past year. It has been a most inspiring thing to me to be in a position where I could observe the quick response to every suggestion that anything ought to be done. The response almost came back before the request could get out. Although I have conveyed my thanks and the thanks of the association to those gentlemen individually, I should like publicly at this time to state that the association could not have done the things it has done, whether good, or small, or large, without exactly that attitude on their part. I believe we are very greatly indebted to them, and I hereby announce my recognition of that indebtedness.

The freight rate matters have been with us this year, as heretofore, and, to a certain extent, in more acute form. The proceedings case is Ex-Parte 87, being a petition of the western carriers to increase the rates on crushed stone in western territory approximately 11% over the present rate, and is really a preliminary to the investigation which will be conducted under Docket 17,000 as ordered by congress. Ex-Parte 87 has to do only with the freight rates in western territory, and, therefore, only concerned western producers, but the association has concerned itself in a defense, and I think a very vigorous defense, of our interests as being opposed to those of the carriers in the western territory; first, because it was a proper support to give to our brothers in the West, and a support we were very glad to give; in the second place, because it is a first line trench—although I do not like to array ourselves in battle formation against the railroads—of defense against a general increase of freight rates under Docket 17,000. The idea behind Docket 17,000 is a seeking to lower the rates on farm products and raise them on all others, of which crushed stone is one.

There are certain suggestions as to the future conduct of our association, upon which I would like to touch very briefly.

Recommends Budget System

Another point is this: the association must place its finances on a budget system. We are going along now in a much too informal manner. I do not mean by "informal" that all the money received is not properly banked and recorded or that proper records are not kept of expenditures, because of course I know they are. The report of the treasurer and the report of the auditors will speak as to that. What I think we are too informal about is as to determining what we shall spend money for. We do not know with sufficient exactness what our income will be, and how much we can spend. Of course the association must not get into debt, and it does not propose to get into debt. The point is, we should know that so much can be spent for the bureau of engineering, so much for the secretary's office, so much for traveling expenses, so much for assistance to the president, so much for stenographic help, and so on, and it should be all on the budget system, and the budget for any particular item should not be exhausted without authority of the board.

Local Divisions

Another suggestion I have for the future bears upon the status of our local associations. I recognize the autonomy of the local associations to their entire independence and the right privilege and propriety of their acting exactly as the interests in their localities make it seem to them to be most advisable. On the other hand, I merely lay before you this thought: that the strength of the pack is in the wolf, and the strength of the wolf is in the pack. The strength of the national association is very largely dependent upon the vigorous strength, growth and activity of the local associations and the support both moral and financial the local associations give to the national. I am equally firmly convinced that the strength of the local associations, to a greater extent than we perhaps realize, will be stimulated and promoted by increasing the strength of the national association. It is, of course, certain that one is helping the other, and I think we should see to it that by some consideration of our clearly mutual interests certain things might be done which would be to the advantage of both.

I was much impressed at the beginning of the year with the establishment in Illinois of the Midwest Division of the National Crushed Stone Association. The men in Illinois were kind enough to submit to me the name they had chosen, and my first reaction was it was unfortunate that particular name had been taken, because there was no provision under our constitution whereby this association could recognize any local association as a division, and I so informed them. I also stated, and I repeat it, that I think the situation is unfortunate, because I feel there should be a provision in our structure whereby any local can be formed, or any local association now in existence can so change its name, to indicate that it is a part of this national body. That they give their strength to us, and we give our strength to them, seems to me a situation to be desired by all of us. After some thought I found myself not only in hearty accord with the Illinois producers, but very grateful to them, and if it be your pleasure the chair will appoint a committee consisting of representatives of various local organizations, in order that those representatives may mutually and jointly consider in what manner, if any, the National Association can be of more value to the local associations.

Officers and Directors of the National Crushed Stone Association Elected at Montreal

Otho M. Graves, President, Drake building, Easton, Penn.
James Savage, Treasurer, Ellicott Square, Buffalo, N. Y.
J. R. Boyd, Secretary, 751 Earle building, Washington, D. C.

Regional Vice-Presidents

A. R. Wilson—Western
G. J. Whelan—Central
Stirling Tomkins—Eastern
Thomas McCroskey—Southern
W. R. Sanborn—Northern
C. M. Doolittle—Canadian

Board of Directors—Ex-officio Members of the Board of Directors

Otho M. Graves, President.
A. R. Wilson, Watsonville, Calif.
G. J. Whelan, Cleveland, Ohio.
Stirling Tomkins, Tomkins Cove, N. Y.
Thomas McCroskey, Knoxville, Tenn.
W. R. Sanborn, Kankakee, Ill.
C. M. Doolittle, Hamilton, Ont., Canada.
M. B. Garber, Chairman, Manufacturers' Division, Orrville, Ohio.

Elected Members of the Board of Directors

A. J. Blair, Milwaukee, Wis.
John Rice, Easton, Penn.
E. J. Krause, St. Louis, Mo.
W. Scott Eames, New Haven, Conn.
F. W. Schmidt, Morristown, N. J.
J. J. Sloan, Chicago, Ill.
H. E. Bair, Toledo, Ohio.
O. P. Chamberlain, Chicago, Ill.
F. C. Murphy, Chicago, Ill.
R. B. Tyler, Louisville, Ky.
W. L. Sporborg, Syracuse, N. Y.
James Savage, Buffalo, N. Y.
Harry Brandon, Piqua, Ohio.
F. R. Kanengeiser, Pennsylvania.
E. C. Dodson, Dallas, Texas.
W. W. Boxley, Roanoke, Va.
B. D. Pierce, Jr., Bridgeport, Conn.
Stuyvesant Peabody, Chicago, Ill.
J. F. Schroeder, Davenport, Iowa.
John Wunder, Minneapolis, Minn.
W. H. Hoagland, Columbus, Ohio.
L. R. Cartwright, Indianapolis, Ind.
J. C. King, Youngstown, Ohio.
F. T. Gucker, Philadelphia, Penn.
W. F. Wise, San Antonio, Texas.

Representing Manufacturers' Division

N. S. Greensfelder, Wilmington, Del.
S. R. Russell, Wilmington, Del.
M. B. Garber, Sanderson-Cyclone Drill Orrville, Ohio.

Directors on the Board of the National Crushed Stone Association

M. B. Garber.
S. R. Russell, E. I. du Pont de Nemours & Co., Wilmington, Del.
N. S. Greensfelder, Hercules Powder Co., Wilmington, Del.

Vice-Chairmen

L. W. Shugg, General Electric Co., Schenectady, N. Y.
Thos. Robins, Jr., Robins Conveying Belt Co., New York City, N. Y.
Gordon Buchanan, C. G. Buchanan Co., New York City, N. Y.
Arthur F. King, Marion Steam Shovel Co., Marion, Ohio.
R. Grubb, Canadian Explosives, Ltd., Montreal, Quebec.
A. E. Holcomb, The Koehring Co., Milwaukee, Wis.

Secretary-Treasurer

J. R. Boyd, 931 Earle Building, Washington, D. C.

Additional Directors Elected—All of the Officers Mentioned Are Directors

C. B. Andrews, Taylor-Wharton Iron and Steel Co., High Bridge, N. J.
Geo. G. Armstrong, Armstrong Manufacturing Co., Waterloo, Iowa.
S. B. Belden, Jeffrey Manufacturing Co., Columbus, Ohio.
Fred A. Gill, Gill Rock Drill Co., Lebanon, Penn.
John M. Johnson, Allis-Chalmers Manufacturing Co., Milwaukee, Wis.
E. G. Lewis, Bucyrus Co., Milwaukee, Wis.
B. G. Shotton, Hendrick Manufacturing Co., Carbondale, Penn.
H. R. Sykes, Fate-Root-Heath Co., Plymouth, Ohio.

List of Exhibitors

Manufacturers' Division Exhibit

Allis-Chalmers Manufacturing Co., Milwaukee, Wis.
Armstrong Manufacturing Co., Waterloo, Iowa.
Austin Manufacturing Co., Chicago, Ill.
Blaw-Knox Co., Pittsburgh, Penn.
Bucyrus Co., South Milwaukee, Wis.
C. G. Buchanan Co., Inc., New York City.
Canadian Explosives Limited, Montreal, Quebec.
Cement, Mill and Quarry, Chicago, Ill.
Columbus McKinnon Chain Co., Columbus, Ohio.
Easton Car and Construction Co., Easton, Penn.
E. I. du Pont de Nemours & Co., Wilmington, Del.
The Fate-Root-Heath Co., Plymouth, Ohio.
Flexible Steel Lacing Co., Chicago, Ill.
Gill Rock Drill Co., Lebanon, Penn.
General Electric Co., Schenectady, N. Y.
Geo. D. Whitcomb Co., Rochelle, Ill.
Hadfield-Penfield Steel Co., Bucyrus, Ohio.
Harnischfeger Sales Corporation, Milwaukee, Wis.
The Hayward Co., New York City.
Hendrick Manufacturing Co., Carbondale, Penn.
Hercules Powder Co., Wilmington, Del.
Keystone Consolidated Publishing Co., Pittsburgh, Penn.
Koehring Co., Milwaukee, Wis.
Koppel Industrial Car and Equipment Co., Koppel, Penn.
Jeffrey Manufacturing Co., Columbus, Ohio.
The Loomis Machine Co., Tiffin, Ohio.
The Lubriko Co., Philadelphia, Penn.
Marion Steam Shovel Co., Marion, Ohio.
Mussens Limited, Montreal, Quebec.
National Crushed Stone Association.
Northern Explosives Limited, Montreal, Quebec.
The Osgood Co., Marion, Ohio.
Pit & Quarry, Chicago, Ill.
Robins Conveying Belt Co., New York City.

ROCK PRODUCTS, Chicago, Ill.
The Sanderson-Cyclone Drill Co., Orrville, Ohio.
S. G. Taylor Chain Co., Chicago, Ill.
Taylor-Wharton Iron and Steel Co., High Bridge, N. J.
The Thew Shovel Co., Lorain, Ohio.
Traylor Engineering and Manufacturing Co., Allentown, Penn.
The W. S. Tyler Co., Cleveland, Ohio.
Vulcan Iron Works, New York City.
Williams Patent Crusher and Pulverizer Co., St. Louis, Mo.

Retiring Secretary of Manufacturers' Division Given a Watch

THE members of the Manufacturers' Division of the National Crushed Stone Association presented the retiring secretary-treasurer, Nathan C. Rockwood, with a beautiful white-gold watch and platinum chain. The watch bears the inscription "'Rocky'—in appreciation of your services so liberally given, 'The Manufacturers' N. C. S. A.—1926."

The presentation took place at the banquet, M. B. Garber, chairman of the Manufacturers' Division, making a kindly presentation speech. The recipient replied as best he could under the circumstances—under the effects of a thrill that comes but once in a life time.

REGISTRATION

A

C. W. Ackerman, Wisconsin Granite Co., Utley, Wisc.
W. M. Acheson, New York State Dept., Public Works, Syracuse, N. Y.
W. M. Andrews, Lake Erie Lime Stone, Youngstown, Ohio.
H. B. Allen, The General Crushed Stone Co., Philadelphia, Penn.
C. B. Andrews, Taylor-Wharton Iron & Steel, Highbridge, N. J.
Wm. A. Armstrong, Universal Granite Quarries Co., Chicago, Ill.
E. R. Atwood, Old Colony Crushed Stone Co., Quincy, Mass.
W. J. Auston, Hercules Powder Co., Chicago, Ill.
C. Abeles, Koppel Industrial Car & Equipment, New York City.
P. H. Austin, Canadian Explosives, Toronto, Ont.
Wm. A. Anderson, Hercules Powder Co., Buffalo, N. Y.
G. G. Armstrong, Armstrong Mfg. Co., Waterloo, Iowa.
Mrs. Wm. Anderson, Safe Sprengstoff Co.
E. V. Ansbach, France Stone Co., Toledo, Ohio.

B

G. C. Bateman, Secretary Ontario Mining Inst., Toronto.
F. E. Bear, Ohio State University, Columbus, Ohio.
C. Blakeslee, New Haven Trap Rock Co., New Haven.
H. E. Bair, France Stone Co., Toledo, Ohio.
Mrs. H. E. Bair, Toledo, Ohio.
M. M. Bales, Elmhurst-Chicago Stone Co., Elmhurst, Ill.
M. M. Bamberger, Interstate Crushed Stone Co., Springfield, N. J.
A. G. Barres, The General Crushed Stone Co., Wilkesbarre, Penn.
T. H. Barrette, Bucyrus Co., New York City.
H. J. Beach, Flexible Steel Lacing Co., Chicago.
P. F. Beam, C. C. Beam Stone Co., Melvin, Ohio.
C. C. Beam, Individual.
L. C. Bonnell, Commonwealth Quarry Co., Summit, N. J.
J. R. Boyd, Secretary N. C. S. A., Washington, D. C.
O. Brand, Barrett Co., Cleveland, Ohio.
H. H. Brandon, Ohio Marble Co., Piqua, Ohio.
C. A. Breskin, **Rock Products**, Chicago, Ill.
S. Brewster, Trojan Powder Co., Chicago, Ill.
Ward & Britton, Britton Cushed Stone Co., Rochester, N. Y.
Jas. W. Buchner, The Lubriko Co., Philadelphia, Penn.
J. P. Bains, Grenville Crushed Rock Co., Merrickville.
H. E. Blatch, Can. Westinghouse Co., Montreal, Que.
J. K. Brandon, Ensign-Bickford Co., Simsbury, Conn.
Milton Burghart, Highway Products Co.
J. Barab, Wilmington, Del.
J. S. Bond, Allis Chalmers Manufacturing Co., Milwaukee, Wis.
B. C. Bussy, Public Official, Rhode Island.
L. Beebe, Tredick Oil & Grease Co., Philadelphia, Penn.
W. G. Blaum, New York State Highways, Albany, N. Y.
H. L. Blakeslee, Connecticut Quarries Co., New Haven, Conn.
D. A. Bridge, A. D. Bridge & Sons Co., Hazardville, Conn.
W. M. Black, American Manganese Co., Chicago Heights, Ill.
D. Bonis, Thames Quarries, Ltd., St. Mary's, Ont.
G. Buchanan, The C. G. Buchanan Co., New York,
A. G. Bennett, Hagersville Quarries, Hagersville, Ont.
L. J. Bennett, Buffalo Cement Co., Buffalo, N. Y.
R. C. Becker, Keyston Con. Pub. Co., New York City.

C

L. R. Cartwright, Midwest Crushed Stone Co., Indianapolis, Ind.
K. E. Casparis, Columbus, Ohio.
D. L. Cheney, The Marion Steel Shovel Co., Marion, Ohio, Rochester, N. Y.
D. S. Chisholm, Boston, Mass.
C. L. Clarke, The Ohio Crushed Stone Assoc., Columbus, Ohio.
C. E. Claus, Columbia Quarry Co., Columbia, Ill.
J. B. Crew, The Marion Steel Shovel Co., N. Y.
R. C. Curley, C. N. R., Chicago, Ill.
J. E. Cushing, Cushing Stone Co., Schenectady, N. Y.
W. B. Custis, C. C. Beam Stone Co., Melvin, Ohio.
R. H. Cox, Rock Cut Stone Co. Syracuse, N. Y.
A. D. Coldwell, Genessee Stone Products, Batavia, N. Y.
O. P. Chamberlain, Vice-President Dolese & Shepard Co., Chicago, Ill.
R. S. Campbell, Holston Quarry Co., Knoxville, Tenn.
H. L. Cox, The Marion Steam Shovel Co., Philadelphia, Penn.
J. C. Carter, The Spencer Construction Co., Baltimore, Ohio.
Mrs. J. C. Carter, Baltimore, Ohio.
J. R. Callanan, Callanan Road Improvement Co., Albany, N. Y.
H. W. Clarke, **Engineering and Mining Journal**, New York.
J. Cole, Northern Explosives Co., Montreal, Que.
G. B. Carver, France Stone Co., Toledo, Ohio.
M. S. Cheney, The Thew Shovel Co., New York City.
H. G. Campbell, H. T. Campbell Sons Co., Towson, Md.
B. S. Campbell, H. T. Campbell Sons Co., Towson, Md.
Sheldon Cary, Browning Crane Co., Cleveland, Ohio.
P. J. Clemens, Jaite Co., Jaite, Ohio.

D

B. G. Dann, Hendrick Mfg. Co., Carbondale, Penn.
H. M. Davison, The Hayward Co., New York City, N. Y.
V. H. Dent, Trojan Powder Co., Allandale, Penn.
W. C. Davis, Atlas Powder Co., Wilkesbarre, Penn.
C. E. Dodson, Chico Crushed Stone Co., Dallas, Texas,
C. M. Doolittle, Canada Crushed Stone, Ltd., Dundas, Ont.
W. W. Duff, Lake Erie Lime Stone Co., Youngstown, Ohio.
J. P. Dawes, Mussens, Ltd., Montreal, Que.
J. E. Dunkel, Kelley Island Lime & Transport Co., Marion, Ohio.
E. R. Duvelle, Hayward Co., New York, N. Y.
T. J. Davis, Town Official.
C. D. Darrow, Supterintendent of Streets, New London, Conn.
J. H. Dougherty, G. D. Whitcomb Co., Rochelle, Ill.
F. C. Diebold, Buffalo Cement Co., Buffalo, N. Y.
P. H. DesRosiers, Joliette Steel, Ltd., Joliette, P. Q.
C. E. Downing, Beachville White Lime Co., Beachville.

E

F. O. Earnshaw, Carbon Limestone Co., Youngstown, Ohio.
Mrs. F. O. Earnshaw, Youngstown, Ohio.
W. Scott Eames, New Haven Trap Rock Co., New Haven, Conn.
Mrs. W. Scott Eames, New Haven, Conn.
M. Edgeworth, Lehigh Stone Co., Kankakee, Ill.
E. E. Evans, The White House Stone Co., Toledo, Ohio
F. H. Edwards, Connecticut Quarries Co., New Haven, Conn.
G. W. Flounders, C. G. Buchanan Co., 90 West St., New York City.
W. E. Foote, Wickwire Spencer Steel Corp., Gasport, N. Y.
G. J. Fredericks, Consolidated Stone & Sand Co., Montclair Heights, N. J.
Edw. Fehlig, St. Louis, Mo.
G. E. Foster, The Greening Wire Co., Hamilton & Montreal.
G. F. Foot, Can. Westinghouse Co., Hamilton, Ont.
G. D. Fraunfelder, Easton Car & Const. Co., Easton, Penn.
J. Franceschini, Kirkfield Crushed Stone, Toronto, Ont.

G

W. H. Gall, Wisconsin Granite Co., Chicago, Ill.
Mrs. Gallagher, Wisconsin Granite Co., Chicago, Ill.
H. T. Gallagher, Wisconsin Granite Co., Swiss Falls, S. D.
M. B. Garber, Sanderson Cyclone Drill Co., Orrville.
E. Gilbert, New Castle Lime & Stone Co., New Castle,
A. T. Goldbeck, N. C. S. A., Washington, D. C.
A. Goldberg, Allis Chalmers Manufacturing Co., Milwaukee, Wis.
R. B. Grant, Graham Coal Co., Philadelphia, Penn.
O. M. Graves, General Crushed Stone Co., Easton, Penn.
N. S. Greensfelder, Hercules Powder Co., Wilmington, Del.
Fred A. Gill, The Gill Rock Drill Co., Lebanon, Penn.
F. M. Goudge, Mines Branch, Ottawa, Ont.
A. W. Guyer, Koehring Co. of Canada, Toronto, Ont.
F. T. Goodman, American Manganese Steel Co., Chicago Heights, Ill.
V. C. Genn, Hyatt Roller-Bearing Co., Harrison, N. J.
R. D. Gordon, Gordon Crushed Stone Co., Toronto, Ont.
E. Godfrey, Canadian Explosives, Ltd., Montreal, Que.
R. Grubb, Canadian Explosives, Ltd., Montreal, Que.
Mrs. W. W. Goetz, S. Milwaukee, Wis.
W. W. Goetz, Bucyrus Co., S. Milwaukee, Wis.
H. Gauthier, Inspector of Mines, Quebec, P. Q.
M. G. Gill, Tar Products Corp., Providence, R. I.
W. E. Greene, Cincinnati Rubber Mfg. Co., New York.
Cornelius D. Garretson, Rotary International, Wilmington, Del.

H

A. A. Hall, Ohio Marble Co., Piqua, Ohio.
M. F. Hall, Atlas Powder Co., Philadelphia, Penn.
M. Hammerschmidt, Elmhurst - Chicago Stone Co., Elmhurst, Ill.
Geo. F. Hammerschmidt, Elmhurst-Chicago Stone Co., Elmhurst, Ill.
E. S. Hanson, **Cement Mill and Quarry**, Chicago, Ill.
Miss M. Heimlich, Leroy, N. Y.
J. L. Heimlich, Leroy Lime & Crush Stone Co., Leroy, N. Y.
H. R. Hilchie, Canada Allis Chalmers Co., Toronto, Ont.
Mrs. L. D. Hudson, Milwaukee, Wis.
L. B. Hudson, Symonds Bros. Co., Milwaukee, Wis.
H. A. Hooker, Buffalo Crushed Stone Co., Buffalo, N. Y.
D. C. Hickie, Rock Cut Stone Co., Syracuse, N. Y.
Elee Heidenreich, Burrell Engineering & Construction Co., Chicago, Ill.
W. H. Haelig, Bound Brook Crushed Stone Co., Bound Brook, N. J.
H. D. Hawthorne, The General Crushed Stone Co., Akron, Ohio.
Chas. V. Higgins, Bound Brook Crushed Stone Co., Bound Brook, N. J.
C. A. Hogentogler, Highway Research Board, Washington, D. C.
F. W. Hukill, Atlas Powder, Wilmington, Del.
A. A. Hall, Ohio Marble Co., Piqua, Ohio.
M. F. Hall, Atlas Powder Co., Philadelphia, Penn.
W. W. Haldimand, Greening Wire Co., Montreal, Que.
W. H. Hall, Old Colony Crushed Stone Co., Massachusetts.
A. R. Hance, Bucyrus Co., Pittsburgh, Penn.
G. A. Hutchinson, Kenn. Rock Asphalt Co., Toronto, Ont.
J. C. Houston, Browning Crane Co., Cleveland, Ohio.
J. E. M. Hume, Gen. Electric Co., Schenectady, N. Y.
H. E. Horwood, Taylor & Arnold Eng. Co., Montreal.
P. Hubbard, The Asphalt Ass'n, New York City.

E. A. Hayes, Lee Marble Works, Inc., Lee, Mass.
F. T. Hallford, Canadian Explosives, Ltd., Montreal.

I

Mrs. J. W. Ireland, Lambertville, N. J.
J. W. Ireland, Lambertville Stone Quarry Co., Lambertville, N. J.
N. S. Ireland, C. C. Beam, Melvin, Ohio.

J

J. M. Johnson, Allis Chalmers Manufacturing Co., Chicago, Ill.
Mrs. H. A. Johnson, Piqua, Ohio.
H. A. Johnson, Ohio Marble Co., Piqua, Ohio.
Mrs. R. Johnson, Delrapids, S. Dakota.
R. Johnson, Superior Cont. Co., Delrapids, S. Dakota.
F. S. Jones, General Crushed Stone, Easton, Penn.
H. M. Jennings, Canada Allis Chalmers, Ltd., Montreal, Que.
A. E. Jennings, **The Canadian Engineer**, Toronto, Ont.
A. E. Jupp, A. E. Jupp Construction Co., Toronto, Ont.

K

L. Keane, Columbus, Ohio.
Mrs. W. J. Keever, Columbus, Ohio.
W. J. Keever, Marble Cliff Quarry Co., Columbus, Ohio.
J. C. King, The Carbon Limestone Co., Youngstown, Ohio.
J. T. Kifty, Gill Rock Drill Co., Lebanon, Penn.
E. J. Krause, Columbia Quarry Co., St. Louis, Mo.
H. C. Krause, Columbia Quarry Co., St. Louis, Mo.
F. R. Kanengeiser, Bessemer Limestone & Cement, Youngstown, Ohio.
C. J. Kline, C. O. Hunsicker Crushed Stone Co., Allentown.
J. T. Kilcourse, John T. Kilcourse, General Contractor, Lawrence, Mass.
Jas. Krape, Water Street Trap Rock Co., Water Street.
W. E. Kleine, Allis Chalmers Mfg. Co., New York.
J. H. Kenehan, Official Reporter, Montreal, Que.

L

M. S. Lambert, Robins Conveying Belt Co., Chicago, Ill.
E. M. Lamkin, Kelley Island Lime & Transport Co., Cleveland, Ohio.
H. Landa, Landa Rock Products Co., New Braunfels, Texas.
Mrs. H. Landa, New Braunfels, Texas.
J. H. Loucks, Albany Crushed Stone, Albany, N. Y.
H. F. Lawrence, W. S. Tyler Co., Cleveland, Ohio.
T. A. Lanigan, General Crushed Stone, Winchester, Mass.
D. L. Loot, Loomis Machine Co., Tiffin, Ohio.
J. H. Lanardson, J. McCormick, E. Providence, R. I.
E. G Lewis, Bucyrus Co., Milwaukee, Wis.
A. S. Lane, J. Lane & Son, Inc., Meriden, Conn.
Mrs. A. S. Lane, Meriden, Conn.
W. H. Lindsay, Can. Crushed Stone Corp., Hamilton, Ohio.
F. A. Lent, Editor, **Stone Magazine**, New York.

M

W. H. Margraf, Marble Cliff Quarries Co., Columbus, Ohio.
J. X. McCormick, Jos. McCormick, Providence, R. I.
J. C. McAvoy, Jos. McCormick, Providence, R. I.
G. F. Morse, Kirkland Crushed Stone, Ltd., Toronto, Ont.
C. A. Mullen, Milton Hersey Co., Montreal.
W. F. McRae, Kirkfield Crushed Stone, Ltd., Toronto.
B. McKinney, West Roxbury Trap Rock Co., West Roxbury, Mass.
J. C. MacDonald, State Highway Commission, Connecticut.
Mrs. Monahan, Alexandria Bay, N. Y.
J. C. Monahan, Wisconsin Granite Co., Alexandria Bay.
S. D. Manning, The Osgood Co., Marion, Ohio.
S. J. Mathewson, Jr., Convention Mgr., Montreal Convention Bureau.
H. W. Munday, **Pit & Quarry**, Chicago, Ill.
W. McGrew, L. & M. Stone Co., New York, N. Y.
J. A. McGuire, Wisconsin Granite Co., Chicago, Ill.
F. A. McHaffie, Can. Crushed Stone Co., Hamilton, Ont.
J. McKechney, National Cusqui Co., Chicago, Ill.
T. McLachlan, Vulcan Iron Works, Wilkesbarre, Penn.
M. E. McLean, E. St. Louis Stone Co., E. St. Louis, Ill.
Mrs. McLean, E. St. Louis Stone Co., E. St. Louis, Ill.
Mrs. A. P. McLelland, Pittsburg, Penn.
J. C. McNichols, Wisconsin Lime & Cement Co., Chicago, Ill.
L. E. Macfayden, Taylor-Wharton Iron & Steel, High Bridge, N. J.
C. H. Macalister, American Crushed Rock Co., Cleveland, Ohio.
Mrs. Chas. H. Macalister, Cleveland, Ohio.
B. Manning, Boston, Mass.
F. C. Murphy, Brownell Improvement Co., Chicago, Ill.
M. C. McKeon, General Crushed Stone Co., Easton, Penn.
W. E. McNasser, Solvay Process, Syracuse, N. Y.
A. B. Mack, Kelley Island Lime & Transport Co., Cleveland, Ohio.
E. J. Mehren, Keystone Catalogues, New York City, N. Y.
B. Marble, Hagersville Quarries, Ltd., Hagersville, Ont.
C. A. Munson, New Haven Trap Rock Co., New Haven, Conn.
M. Montgomery, Delaware River Quarry & Construction Co., Lambertville, N. J.
F. A. Moseley, Austin Mfg. Co., Montreal & Chicago.
W. McCrea, Mussens, Ltd., Montreal, Que.
W. C. MacDowell, Traylor Engineering & Manufacturing Co., Allentown, Penn.
Mrs. W. C. MacDowell, Allentown, Penn.
A. McKernan, New Haven Trap Rock Co., New Haven, Conn.
F. T. McAvoy, Mass. Dept. Public Works, Boston, Mass.
J. F. McCormick, J. McCormick, East Providence, R. I.
Jos. McCormick, Jr., Jos. McCormick, Providence, R. I.
J. A. Murphy, Rock-Cut Stone Co., Auburn, N. Y.
W. A. Murray, N. Y. C. R. R., New York, N. Y.
John A. Macdonald, State Highway Commissioner, Connecticut.

N

R. N. Nicol, Dupont Co., New York, N. Y.
R. C. Noll, Whitrock Quarries, Bellefonte, Penn.
B. H. Norton, E. I. Dupont de Nemours Co., Rochester, N. Y.
G. D. Nicol, G. D. Whitcomb Co., Rochelle, Ill.
W. F. Nothaker, Sanderson Cyclone Drill Co., New York, N. Y.
N. J. Noxon, Thames Quarry Co., St Mary's, Ont.
J. V. Neubert, N. Y. C. R. R., New York, N. Y.

O

J. O'Brien, Lee Marble Works, Inc., Lee, Mass.
J. H. Odenbach, Dolomite Products Co., Rochester, N. Y.
J. F. O'Brien, Pulp & Iron Works, Wilkesbarre, Penn.
C. F. Owens, Rock Cut Stone Co., Auburn, N. Y.
A. S. Owens, Peerless Quarries, Inc., Utica, N. Y.
Mrs. A. S. Owens, Utica, N. Y.
Mrs. C. F. Owens, Auburn, N. Y.
A. C. O'Laughlin, President A. C. O'Laughlin Co., Chicago, Ill.
I. G. Owens, Water Street Trap Rock Co., Water Street, Penn.

P

S. E. Parker, Northern Explosives, Ltd., Providence, R. I.
A. Patterson, Bluffton-Lewisburg Stone Co., Findlay, Ohio.
B. D. Pierce, Jr., Connecticut Quarries, New Haven, Conn.
E. E. Pollock, Bucyrus Co., S. Milwaukee, Wis.
Leon Poorman, The France Stone Co., Toledo, Ohio.
L. Perini, P. Perini & Sons, Ltd., Massachusetts.
J. R. Perini, P. Perini & Sons, Ltd., Massachusetts.
E. T. Perry, New Haven Trap Rock Co., New Haven, Conn.
H. O. Parker, Mass. Dept. Public Works, Taunton, Mass.
E. W. Pilgrim, General Electric Co., Schenectady, N. Y.

R

J. Raynard, Loomis Machine Co., Tiffin, Ohio.
C. A. Riggs, Loomis Machine Co., Tiffin, Ohio.
Russell Rarey, Marble Cliff Quarries, Columbus, Ohio.
A. E. Reed, W. S. Taylor & Co., Cleveland, Ohio.
P. B. Reinhold, Reinhold Co., Inc., Pittsburg, Penn.
T. M. Ripley, State Dept. of Public Works, New York, N. Y.
N. C. Rockwood, **Rock Products**, Chicago, Ill.
H. E. Rhodes, Franklin Lime Stone Co., Nashville, Tenn.
S. R. Russell, Dupont Co., Wilmington, Del.
John Rice, President, The General Crushed Stone Co., Easton, Penn.
B. P. Rex, General Crushed Stone Co., Interstate Amiesite Co., Easton, Penn.
John Rice, Jr., The General Crushed Stone Co., Easton, Penn.
J. A. Rigg, Acme Lime Stone Co., Alderson, W. Va.
H. M. Rigg, Acme Lime Stone Co., Alderson, W. Va.
W. H. Redman, Koppel Industrial Car & Equipment Co., Chicago, Ill.
G. C. Riley, Northern Explosives Co., Montreal, Que.
T. Robins, Jr., Robins Conveying Belt Co., New York, N. Y.
W. E. Rowe, Hagersville Quarries, Ltd., Hagersville, Ont.
F. E. Rogers, Air Reduction Sales Co., New York, N. Y.
R. J. Reigeluth, Connecticut Quarries Co., New Haven, Conn.
R. M. Robinson, J. S. Lane & Son, Inc., Meriden, Conn.
J. W. Rollins, Boston, Mass.

S

J. B. Sackley, The J. A. Sackley Co., Chicago, Ill.
Mrs. A. Savage, Buffalo, N. Y.
A. S. Savage, Buffalo Crushed Stone Co., Buffalo, N. Y.
C. L. Sawyer, France Stone Co., Toledo, Ohio.
J. L. Schafer, France Stone Co., Toledo, Ohio.
A. E. Schneider, Williams Crusher & Pulverizer Co., St. Louis, Ill.
F. J. Schermer, The Armstrong Mfg. Co., Waterloo, Ill.
O. A. Scott, Bluffton-Lewisburg Stone Co., Findlay, Ohio.
F. A. Sloan, Wisconsin Granite Co., Berlin, Wis.
W. S. Snider, Of the Templeton Lime Stone Co., Templeton, Penn.
F. W. Schmidt, Jr., Morristown, N. J.
Mrs. F. W. Schmidt, Morristown, N. J.
F. W. Schmidt, New Jersey Quarry Co., Morristown, N. J.
L. W. Shugg, General Electric Co., Schenectady, N. Y.
P. A. Schroder, Minneapolis, Minn.
Mrs. H. H. Sharpe, Toledo, Ohio.
H. H. Sharpe, France Stone Co., Toledo, Ohio.
Howard E. Smith, York State Division Engineer.
Geo. A. Schaefer, General Crushed Stone Co., Rochester, N. Y.
A. L. Scott, General Crushed Stone Co., Easton, Penn.
A. G. Seitz, Rock Cut Stone Co., Syracuse, N. Y.
James Savage, Buffalo Crushed Stone Co., Buffalo, N. Y.
V. I. Sloan, Universal Granite Quarries, Chicago, Ill.
D. C. Souder, France Stone Co., Toledo, Ohio.
G. P. Soutar, Barrett Co., Montreal, Que.
W. L. Sporborg, The Rock Cut Stone Co., Syracuse, N. Y.
H. R. Sykes, The Fate-Root-Heath Co., Ltd., Ohio.
Jas. Shanks, T. A. Morrison & Co., Ltd., Montreal, Que.
M. W. Sherwood, Jeffrey Mfg. Co., Columbus, Ohio.
W. R. Sanborn, Lehigh Stone Co., Kankakee, Ill.
F. W. Shaw, Columbus, McKinnon Chain Co., Columbus, Ohio.
O. M. Sheridan, Washburn & Sheridan Cons. Co., Boston, Mass.
L. P. Smith, Wickwire Spencer Steel Co., Buffalo, N. Y.
W. A. Sullivan, J. T. Kilcourse, Lawrence, Mass.
J. Stephens, Can. Crushed Stone Association, Dundas, Ont.
J. W. Stull, Liberty Lime & Stone Co., Rocky Point, Penn.
R. Smith, Northern Explosives, Ltd., Montreal, Que.
D. H. Storms, Bituminous Spraying Co., Toronto, Ont.
S. L. Squire, Deputy Minister of Highways for Ontario, Toronto.
H. E. Smith, Rogers Supply Co., Toronto, Ont.
F. B. Smith, Bucyrus Co., Pittsburg, Penn.

T

F. N. Taft, Morris County Crushed Stone Co., Millington.
J. C. Taylor, Jr., Taylor-Wharton Iron & Steel Co., Highbridge, N. J.
Werner Troeger, Harnischfeger Corp., Milwaukee, Wis.
R. B. Tyler Co., Louisville, Ky.
J. E. Troy, Mass. Dept. of Public Works, Middleboro, Mass.
J. K. Talbot, President, Dolese & Shephard, Chicago, Ill.
F. P. Thornton, Cincinnati Rubber Mfg. Co., New York City.
A. V. Tremble, Hydro Electric Power Commission, Toronto, Ont.
A. Taylor, A. E. Jupp Const. Co., Toronto, Ont.
Sir Henry Thornton, President Canadian National Railways.

U

A. J. Underwood, Hyatt Roller Bearing Co., Newark, N. J.

Charles M. Upham, State Highway Engineer, North Carolina.

V

H. D. VanCamp, VanCamp Stone Co., Cincinnati, Ohio.
Carl Van Voorhis, Ohio Crushed Stone Co., Columbus, Ohio.
J. E. Vanier, Montreal Crushed Stone Co., Montreal, Que.
S. P. Vanhyning, Peerless Quarries, Utica, N. Y.
R. W. Vail, Thew Shovel Co., Lorrain, Ohio.
S. F. Virtue, The Hadfield-Penfield Steel Co., Bucyrus.
G. VanAlstyne, Air Reduction Sales Co., New York City.

W

J. E. Weber, Casper Stolle Quarry & Constructing Co., E. St. Louis, Ill.
Mrs. J. E. Weber.
C. A. Wincell, Universal Granite Co., Lauraville, Wis.
W. F. Wise, Strington Crushed Rock Co., Santa Antonio, Texas, Trap Rock Corp.
W. H. Wiske, Wisconsin Granite, Red Granite, Wis.
W. I. Wortman, Morris County Crushed Stone Co., Morristown, N. J.
Mrs. W. I. Wortman, Morristown, N. J.
A. L. Worthen, Connecticut Quarries Co., Inc., New Haven, Conn.
E. R. Wilson, Marion Steam Shovel Co., Marion, Ohio.
F. J. Waddell, Dolamite Products Co., Rochester, N. Y.
N. O. Weil, W. S. Tyler Co., Cleveland, Ohio.
J. Wunder, c-o J. Wunder Co., Minneapolis, Minn.
L. N. Worman, Albany Crush Stone, Feurobush, N. Y.
J. M. Ward, Mussens, Ltd., Montreal, Que.
H. B. Wilmot, Mussens, Ltd., Montreal, Que.
N. Whitecraft, The Hadfield-Penfield Steel Co., Bucyrus.
L. A. Webster, Keystone Lubricating Co., Philadelphia, Penn.
Thos. Whitefield, Town Official.
F. O. Wyse, Bucyrus Co., S. Milwaukee, Wis.
R. A. Wholley, Blaw-Knox Co., Pittsburg, Penn.
E. Warren, The Lubriko Co., Philadelphia, Penn.
T. B. Woodyatt, American Manganese Steel Co., Chicago Heights, Ill.
C. F. K. Woodyatt, American Manganese Steel Co., Chicago Heights, Ill.
Geo. A. Wendt, Can. Westinghouse Co., Montreal, Que.
E. C. Welden, Connecticut State Highway Commission, Hartford, Conn.
F. C. Wales, Chazy Marble Co., Chazy, N. Y.

Y

W. Young, Atlas Powder Co., Wilmington, Del.
W. R. Young, E. C. Baken Co., New York City.

Jury Appointed to Award Safety Trophy

THE following named have consented to serve as members of a jury of award to select the winners of the bronze trophy, "Sentinels of Safety," to be awarded by *The Explosives Engineer* to the coal mine, the metal mine, and the quarry or open-pit mine sustaining the smallest loss of time from accidents in proportion to total time worked during the year 1925 as determined by a tabulation of mine accident data prepared by the statistical division of the Bureau of Mines:

H. Foster Bain, secretary, American Institute of Mining and Metallurgical Engineers.

James F. Callbreath, secretary, American Mining Congress.

W. H. Cameron, managing director, National Safety Council.

H. L. Gandy, secretary, National Coal Association.

A. T. Goldbeck, director, engineering bureau, National Crushed Stone Association.

William Green, president, American Federation of Labor.

H. G. Jacobsen, manager, bureau of accident prevention and insurance, Portland Cement Association.

The national safety competition for the "Sentinels of Safety" trophy received the official endorsement of the American Mining Congress at its recent annual convention in Washington, when the following resolution was passed:

WHEREAS, The American Mining Congress holds that safety is a consideration of primary importance in mining, and

WHEREAS, One of the chief functions of the U. S. Bureau of Mines is to promote safety in the mining industry, and

WHEREAS, The purpose of the National Safety Competition, now being conducted under the auspices of the U. S. Bureau of Mines, are to create a more lively interest in safety among all mine workers and to secure more complete statistical information on the causes of accidents and the means of preventing them than has heretofore been available,

Bronze safety trophy for best record in quarry accident prevention

THEREFORE, BE IT RESOLVED, That the American Mining Congress gives its endorsement to the National Safety Competition and recommends to all of its members that they participate in this worthy movement by supplying the prescribed reports to the U. S. Bureau of Mines.

The director of the Bureau of Mines has addressed a letter to mines and quarries throughout the United States, informing them that the winners of the 1925 contest will be announced as soon as the accident reports submitted have been thoroughly examined and tabulated by the bureau. He calls attention to the fact that nearly 300 mines and quarries were entered in the 1925 contest, and invites all mines and quarries that have not yet entered the contest to do so for the coming year.

The National Safety Council has recently brought the national safety competition to the attention of the members of its mining and quarrying section and is actively supporting the plan.

The formal presentation of the trophies will take place at the International First Aid and Mine Rescue Meet, to be held under the auspices of the Bureau of Mines in the autumn of 1926. In addition to the award of replicas of the bronze trophy to the coal mine, the metal mine and the quarry having the best safety record, every employee at the mine or quarry so distinguished will receive a certificate of honor signed by the director of the Bureau of Mines and by the state mine inspector of the particular state.

The "Sentinels of Safety" trophy, which was designed by the well-known sculptor, Begni del Piatta, portrays in bronze a mother and child greeting the father upon his safe return from work. The names of the mines and quarries who win the right to hold the trophy for a year will be engraved on the pedestal. The trophy is at present on view in the Washington office of the Bureau of Mines.

Missouri Farmers Use 100,000 Tons of Limestone in 1925

TEN times as much ground limestone was used in Missouri for agricultural purposes in 1925 as in the year 1920, according to P. F. Schowengerdt of the Missouri College of Agriculture. The college has just completed a state-wide survey which shows that Missouri farmers used 101,976 tons of limestone in 1925, whereas they used but 10,000 tons in 1920. The information concerning the amount used in 1925 was compiled from reports recently received from county agents, vocational agriculture teachers, managers of farmers' exchanges, and leading farmers in 77 counties in the state. —*Crane (Mo.) Chronicle.*

Federal Tax Dates for 1926

MARCH 15—Federal income tax returns for individuals, corporations, partnerships and estates to be filed with Collector of Internal Revenue. (Fiscal year returns due 75 days after close of fiscal year.) Penalty attached for failure to file returns. Returns of information as to payments to employees due. First quarterly installment of 1925 federal income tax due (total amount optional).

June 15—Second quarterly installment of 1925 federal income tax due. Withholding agents must pay tax withheld.

July 1—Federal capital stock tax returns must be filed by corporations any time after July 1 and up to July 31.

July 31—Federal occupational return and tax due.

September 15—Third quarterly payment of 1925 federal income tax due.

December 15—Final installment of 1925 federal income tax due.

—*Samuel Newberger & Co., New York.*

Non-Metallics Have a Prominent Place in Mining Engineers' Convention

Annual Meeting of the American Institute of Mining and Metallurgical Engineers at New York City, February 15 to 18

By Oliver Bowles
Secretary, Non-Metallic Minerals Committee, A. I. M. M. E.

THE AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS meets in annual convention in the Engineering Societies' building, 29 West 39th street, New York City, February 15 to 18. Many papers will be presented on the metals, petroleum, coal, safety, industrial relations and allied subjects. The nonmetallic session, however, promises to be of greatest interest to rock products manufacturers and users.

Prof. H. Ries of Cornell University and Oliver Bowles of the Non-Metallic Minerals Station of the U. S. Bureau of Mines, chairman and secretary, respectively, of the committee, have been exerting special efforts since last spring to secure a program worthy of the importance of these basic industries. The main features of the program will be a symposium on sand and gravel, an unusual subject for a mining engineers' convention, but none the less important on that account.

Sands are being applied to new and wider uses year by year. The requirements for such uses are becoming better standardized and the specifications more rigid. This has led to two distinct lines of inquiry. First a keener research directed toward the inherent qualities of sands, and second the development of equipment which will classify and purify sands in accordance with the more rigid specifications. Thus an industry which in early days possessed very crude technique has developed many refinements; many new and difficult problems are constantly appearing and therefore the necessity for applying engineering skill is becoming more and more apparent.

Symposium on Sand and Gravel

The papers to be presented are all by authoritative authors and cover subjects of great importance to the sand and gravel industries of today. The following brief notes on the papers and their authors indicate the character and scope of the subjects to be discussed.

"Mining and Preparation of Foundry Sands," by R. M. Bird. Mr. Bird is affiliated with the well-known George Pettinos Co. of Philadelphia, and is thoroughly familiar with this company's extensive sand operations in southern New Jersey. Therefore the information he presents is based on practical experience and investigation.

"Requirements and Testing of Foundry Sands," by H. Ries. A few years ago there was established a "Joint Committee on Molding Sand Research," organized by the American Foundrymen's Association in cooperation with the National Research Council. Its purpose has been to develop more data on the available supply and methods of rejuvenating of molding sands, also a wider knowledge of their properties and uses. Prof. Ries has taken a prominent part in the work of this committee being chairman of the sub-committee on Geological Surveys. Thus his discussion is based on a wide knowledge of the data accumulated by the committee.

"Occurrence, Properties, Preparation and Distribution of Glass Sands," by Prof. Fettke. The author is a member of the staff of Carnegie Institute of Technology at Pittsburgh, and is an authority on glass sands.

"Washing and Sizing Sand and Gravel," by Edmund Shaw. As Mr. Shaw is one of the editors of ROCK PRODUCTS he needs no introduction to readers of this journal. His numerous articles on sand and gravel that have appeared in various numbers of the magazine stamp him as an authority in this field, and his paper prepared for the coming convention covers the basic principles of washing and sizing in the same comprehensive manner.

"The Preparation and Use of Special Sands," by W. M. Weigel. Mr. Weigel is a well-known mineral technologist in the Bureau of Mines. He has published quite a number of articles embracing the results of his extensive studies of sand and gravel covering a period of several years. The above paper comprises a summary of many important conclusions that are of practical interest to both producers and users of miscellaneous sands, such as engine sand, and abrasive sand.

The five papers given above together with the discussion that will accompany their presentation should afford a very interesting session for those connected in any way with the sand and gravel industries.

Borate and Magnesite

In addition to the papers on sand and gravel two other papers have been prepared on equally interesting subjects. The first is entitled "Borate Deposits Near Kramer, Calif.," by Hoyt S. Gale. The author was long associated with the U. S. Geological Survey specializing in salt, nitrates, potash, borax and many other minerals. His paper deals with the origin and nature of the deposits and their classification as placer or lode as defined in mining law. The final paper, "Magnesite and Magnesia," is by Hugh M. Henton, assistant professor of mining and metallurgy of the State College of Washington at Pullman. Many methods have been tried for the successful recovery of magnesia from dolomite. This paper gives in detail a method worked out through long research by a large operating company in the Middle West. The results have not been published heretofore, and they relate to a subject of more than ordinary interest particularly in the East where all magnesite must be imported or shipped from the far Western states.

Readers who are interested in the above papers may obtain preprints of at least some of them by writing directly to the secretary of the A.I.M.M.E., 29 W. 39th street, New York City. The preliminary program provides that the Non-Metallic Session shall be held at 9:30 a.m. on Monday, February 15. All ROCK PRODUCTS readers who can be in New York on that day are cordially invited to attend the session, whether they are members or non-members of the institute. Written discussion of the papers is desired even though the writers may not be able to attend in person.

Analyses of Alabama Coals

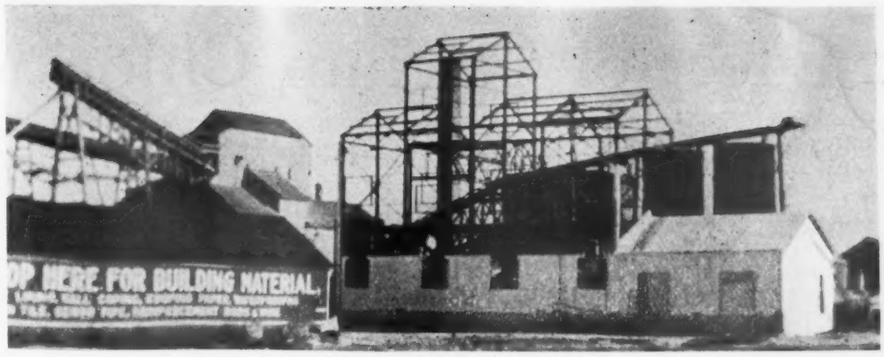
THE Bureau of Mines has recently published a bulletin containing analyses of the coals of Alabama and which is of great value to all cement, lime, gypsum, and other producers of rock products who use large quantities of coal. The localities of the coal beds within the state and many analyses of these from different mines are given, so that at a glance the large coal user may decide on the coal he is to use with regard to quality and distance to be hauled. A brief description of the geology of the coal basins and typical mining operations and a statement of the production by counties are included in the publication which is known as Technical Paper 347, and may be obtained by sending 15 cents to the Superintendent of Documents, Government Printing Office, Washington, D. C.

Sheboygan Lime Works Adds New Hydrate Plant

THE new hydrate plant at the Sheboygan Lime Works, Sheboygan, Wis., has recently been completed and is now reported in operation. The product will be marketed under the name of "Sheboygan" hydrated lime. The Sheboygan company is one of the oldest lime manufacturers in the state having been operating since 1854. The quarry covers about 9 acres and has a face of from 60 to 100 ft. Four kilns are in operation to make the lump and bulk lime which were the chief lime products before the new hydrate plant was erected. Contract has been awarded for the erection and installation for two additional and larger, modern type kilns. The steel shells, tramway, etc., will be furnished by the Manitowoc Engineering Works, Manitowoc, Wis. Accessories such as hoppers, grates and doors are from the Optemberg Iron Works, Sheboygan. A. P. Green Co., Chicago, will supply the fire brick and blocks.

The new fireproof hydrate building, 25x90 ft. in size, has a concrete foundation, concrete floors for the first and second story and is constructed of structural steel furnished and erected by the Manitowoc Engineering Works, Manitowoc, Wis.

The equipment was installed by H. Miscampbell, Duluth, Minn. A No. 2 Sturtevant crusher to crush the lump lime to ¼-in. and finer is placed in the lime shed and the crushed lime is elevated 45 deg. by a bucket elevator and carried across a bridge over the tracks by means of 30 ft. spiral conveyor into a 50-ton crushed lime storage bin. This is connected with the weighing hopper which measures the crushed lime into a Clyde hydrator. By means of an automatic scale the water contained in a galvanized iron water tank is also measured into the Clyde hydrator. After the lime has been thoroughly hydrated it passes down into a steel discharge hopper, through a Clyde cooler and into a Raymond pulverizer and separator. Here all particles not thoroughly hydrated are removed and the hydrated lime is conveyed into a steel dust-tight hopper. To this hopper is attached a Bates 4-tube lime packer manufactured by the Valve Bag Co., Toledo, Ohio. The No. 3 Clyde hydrator installed has a capacity of 4 tons per hour and better, making over 30 tons per 8 hour day. The building and all machinery installed is arranged so a second No. 3 hydrator can be installed at any time.



Crushing plant, kilns, and hydrate plant under construction at the Sheboygan Lime Works, Sheboygan, Wis.

The officers of the Sheboygan Lime Works are: president, Henriette E. Roth; vice-president, Louis Kanitz, Muskegon, Mich.; secretary-treasurer, Elfrieda H. Roth.

Miss Elfrieda H. Roth has been general manager of the plant for the past 10 years T. E. Fleischer is superintendent.

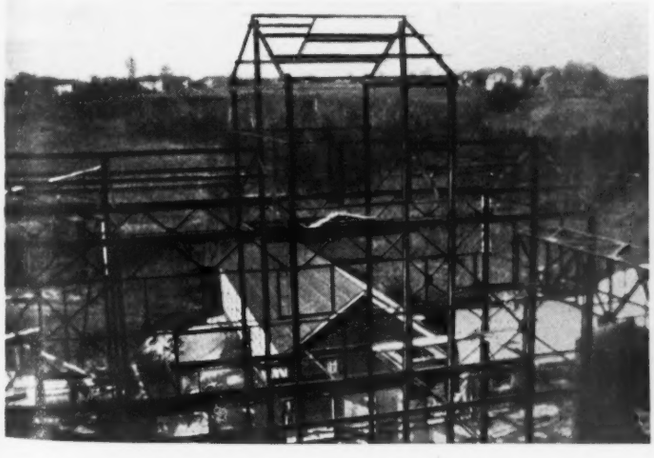
Recommended Code for Rock Dusting Coal Mines

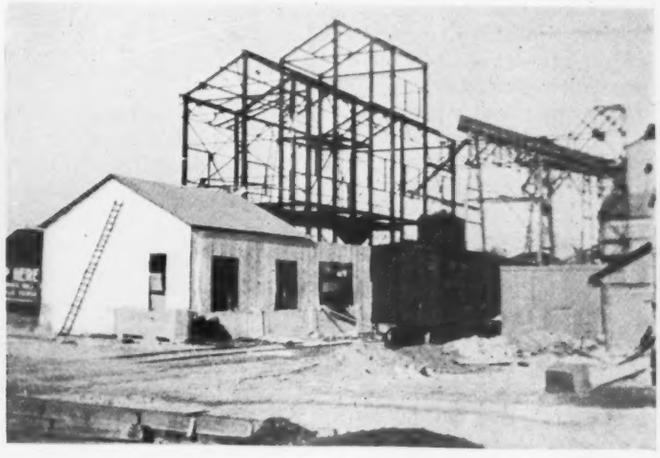
THE American Engineering Standards Committee has just approved as "Recommended American Practice" a safety code for rock dusting of coal mines, developed under the sponsorship of the American Institute of Mining and Metallurgical Engineers, in close co-operation with representatives of the various national bodies interested, including state officials having regulatory power over the field in question, coal operators, labor, inspection, insurance, manufacturers of mine equipment, and the United States Bureau of Mines. The latter, as a leader in mine safety work, has conducted extensive investigations and experiments under the direction of Dr. George S. Rice, before advocating this method.

The chairman of the sectional committee for the formulation of the code is Howard N. Eavenson, consulting engineer.

The code prescribes the rock dusting of mines producing bituminous coal, or lignite, whether gaseous or not, as they are liable to dust explosions. It specifies the kind and amount of dust to be used and the parts of the mine to be dusted. The methods of applying the dust and instructions for its sampling are also given.

A report by Edward Steidle, supervisor of the co-operative coal mining courses at Carnegie Institute of Technology, who has been making a study of this subject in connection with the Bureau of Mines investigations, presents data on the increase in the use of rock dusting during the past year, which emphasizes the importance which coal mine operators place on the prevention of explosions. During 1924 only one company in America practiced rock dusting on any large scale, but at present no less than 211 mines are rock dusted. However, this represents only about 4% of the total number of bituminous mines in the United States.





Left—Steel frame work of hydrate plant. Right—Hydrate plant under construction showing bridge for conveyor over the tracks

Effect of Calcium Chloride on Cement*

Summary of Results of European Experiments and Experience Written Especially for Rock Products

By Dr. C. E. Platzmann
Consulting Cement Plant Engineer, Berlin, Germany

IN a recent issue[1] the author pointed out the nature of the problem of calcium chloride used as admixture in cement. He also emphasized the fact that so far no real explanation has been advanced of the effect of calcium chloride on cement. In view of this, it might be of interest to review the present state of research on this subject with special reference to recent tests made by the author.

The peculiar behavior of cement in contact with calcium chloride has been for years the object of scientific and commercial inquiry; the former can be traced back, to my knowledge, as far as 1886 (Candlot, Le Chatelier, Heintzel). In recent years this problem was studied by the following: Spiegelberg, the present director of the Degerhamm cement plant (Sweden), Dr. F. Killig and the director of the Dusseldorf Cement Institute, Dr. A. Guttmann. In connection with these the author conducted extensive series of tests and, of late, this problem was investigated by V. Frost of the Swedish State Testing Laboratory. Reports of tests published in America (1923) in *Concrete* and the *Engineering News-Record* by P. Cottringer, H. S. Kendall, U. F. Clemmer and F. Burggraf have not as yet been accessible to the author, so that, unfortunately he is unable to quote them.

When a few years ago the author began his investigation of the subject in question, the general status in that field of research was as follows: Guttmann's investigations bore special reference to the beneficial effect of calcium chloride on shrinkage of cement; he demonstrated at the same time that curing of specimens made of portland and iron portland cement in a saturated $CaCl_2$ solution (50%) resulted in their complete deterioration, while slag cement specimens showed only a reduction in strength. Spiegelberg used in his tests cements with considerable admixtures of gypsum and showed the beneficial effect of calcium chloride in preventing unsoundness[2]. However, when gypsum is added in amounts greater than 9%, unsoundness results in spite of $CaCl_2$ admixtures up to 2%. Further, Spiegelberg obtained with the use of calcium chloride admixtures, values of compressive strength up to 200% above standard, while the tensile strength showed little or no increase. These deviations from the standard strength values are obviously the most remarkable feature of the effect of calcium chloride on cement. It is notable in this connection that the increase in compressive strength is more pronounced in rotary kiln products, while those of the shaft kiln show a less marked effect. Basing his conclusions on original tests, Killig offers the following explanation of the observed increase in strength. As lime is more soluble in $CaCl_2$ solutions than in water, the reactions taking place during setting are accelerated through increased formation of crystals as well as higher temperature during setting. Killig also demonstrated that admixtures of calcium chloride produce greater constancy of volume in cement.

Such were the general conditions recorded in available literature, when I was confronted with the problem—before the introduction of high strength and special cements in Germany—of producing a concrete of high early strength, also showing the least possible amount of shrinkage. It seemed adequate in seeking to satisfy these requirements to make an investigation of $CaCl_2$ admixtures. This investigation is described below.

The cement first used in these tests conformed to German standard specifications with regard to fineness, soundness and time of setting. It gave the following chemical analysis:

	Per Cent
SiO_2	21.33
Al_2O_3, Fe_2O_3	11.74
CaO	62.60
MgO	1.98
SO_3	1.70
Loss on ignition	0.74
	100.09

Compression and tension tests were made of 1:2 and 1:3 (by weight) mortar at ages of 7, 28, 56 and 90 days. The following values were recorded:

TABLE I

Mix	Age at Test, Days		Compression kg. per sq. cm.*	Tension kg. per sq. cm.*
1:2	7		365	37.0
	28	comb. curing	534	60.6
	56	(3)	560	62.0
	90		575	63.5
1:3	7		189	19.6
	28	comb. curing	339	38.2
	56		377	40.5
	90		385	41.1

Each value in this as well as in the following tables is the average of at least three, often of five and in some cases of seven individual tests. In tests involving $CaCl_2$ admixtures 1 to 5% solution of $CaCl_2$ were used as mixing water. Dry admixtures of calcium chloride were not used for the following reasons: First, because it was desired to obtain results comparable with Killig's series; second, because the hygroscopic property of calcium chloride is so high that undoubtedly partial setting results during making of the specimens; the results of such tests being only of an imaginary value. Killig also observed that by means of a $CaCl_2$ admixture a slow-setting cement could be changed to a quick-setting cement. Similar, though not as extensive observations were recorded by W. L. Gadd in his tests carried out for the British Portland Cement Research Association. I am reproducing here his data published in Bulletin 1 of the association:

Salt Added	Accelerated	Retarded	Remarks
Anhydrous $CaCl_2$	all cements	—	little effect on setting time
Cryst. $CaCl_2$, $6H_2O$	all cements (over 1% add.)	all cements (up to 1% add.)	—

Though in my tests a certain reduction of time of setting was also observed—from 4 hr. 25 min. to 3 hr. 15 min.—there could be no question of a change to quick-setting properties, for no difficulty was encountered in making the specimens in accordance with German standards. The results of tests were as follows:

TABLE II
(Mix 1:2)

Mixing Water Solution of	Age at Test, Days		Compression kg. per sq. cm.	Tension kg. per sq. cm.
1% $CaCl_2$	7		404	30.4
	28	(combined	600	63.6
	56	curing)	551	61.2
2% $CaCl_2$	7		391	32.3
	28	(combined)	620	64.1
	56		620	60.6
	90		.....	58.3
3% $CaCl_2$	7		403	31.9
	28	(combined)	643	63.9
	56		601	60.7
	90		577	61.9
4% $CaCl_2$	7		477	36.3
	28	(combined)	642	64.3
	56		571	54.7
	90		602	56.0
5% $CaCl_2$	7		444	30.8
	28	(combined)	645	63.9
	56		624	61.3
	90		638	48.6

TABLE III
(Mix 1:3)

Mixing Water Solution of	Age at Test, Days		Compression kg. per sq. cm.	Tension kg. per sq. cm.
1% $CaCl_2$	7		226	18.1
	28	(combined	376	40.5
	56	curing)	394	37.4

* Translated by Margaret C. Arronet.

(1) Problems in Cement and Concrete Research, Rock Products, May 2, 1925, p. 56.

(2) In individual cases Schindler has found that unsoundness due to gypsum is produced in spite of calcium chloride admixtures, a fact confirmed by Guttmann.

* Note: To reduce the strength values to 1 lb. per sq. in., multiply by 14.2.

(3) Combined curing = 1 day moist air, 6 days water, 21 days air curing.

TABLE III (Continued)

2% $CaCl_2$	7	208	18.9
	28 (combined)	381	44.4
	56	365	-----
3% $CaCl_2$	7	243	18.9
	28 (combined)	384	39.6
	56	384	33.9
	90	-----	31.7
4% $CaCl_2$	7	249	20.5
	28 (combined)	414	39.1
	56	363	34.1
	90	375	28.9
5% $CaCl_2$	7	228	15.5
	28 (combined)	395	34.6
	56	398	37.7
	90	376	35.5

The results of these tests are plotted in Figs. 1 and 2. They show that a 4% $CaCl_2$ solution used as mixing water gives highest increase in compressive strength; while Killig obtained the highest increase with a 2% solution. In general, the values of tensile strength remain unchanged. At later ages, these values show a slight retrogression which, strictly speaking, applies also to compression whose values at 56 and 90 days show less appreciable gain compared to those of specimens without admixture. Before attempting to draw conclusions from these results, I wish to quote results of other tests made to reproduce those of Spiegelberg and Guttmann with the idea of confirming their claim that calcium chloride has a beneficial effect on unsoundness due to gypsum. The same cement was used in these tests with gypsum added in amounts of 2, 4 and 6%. A 2% $CaCl_2$ solution was used as mixing water. The following values were obtained showing considerable losses in strength for 1:3 standard mortar specimens:

TABLE IV

Mix: 1:3. Mixing water: 2% $CaCl_2$ Solution

Gypsum Added	Age at Test, Days	Compression kg. per sq. cm.	Tension kg. per sq. cm.
2%	7	78	11.2
	28 (combined curing)	233	22.7
4%	7	82	10.2
	28 (combined)	195	19.8
6%	7	74	10.0
	28 (combined)	194	20.3

Up to this point the effect of calcium chloride appears to me to be hinged on two factors. The strongly hygroscopic properties of calcium chloride prevent the formation of hair and shrinkage cracks in the specimens by absorbing moisture from the air and thus keeping the cement through the first period of hardening from too rapid drying. This theory would explain the gain in compressive strength up to the age of 28 days; the subsequent decrease in strength with a correspondingly flattened slope of the curve could be explained by the destructive action of calcium chloride at later ages, when as soluble chloride it acts similarly to sulphates producing instead of the calcium sulphoaluminate a similar chloro-aluminate. The presumably beneficial effect of calcium chloride on cements with gypsum admixtures consists, in my opinion, in an initial retarding of the harmful action of gypsum due to high solubility and hygroscopic properties of calcium chloride, while at later ages the specimens probably show the destructive action of both gypsum and calcium chloride. This theory is seconded by the assumption expressed by Killig, that increased crystalline growth is produced with higher temperature during setting. This assumption appears reasonable, as I have established similar conditions in another connection.[4] It was shown that at ordinary temperature calcium chloride reacts with cement actively enough to accelerate crystalline growth during setting in the presence of calcium chloride with simultaneous formation of tricalcium aluminate ($3CaO \cdot Al_2O_3$) and considerable rise in temperature. There can be no doubt that this greater affinity is based on

(4) Gas Bubbles in Porous Concrete, Sept. 8, 1923, p. 39.

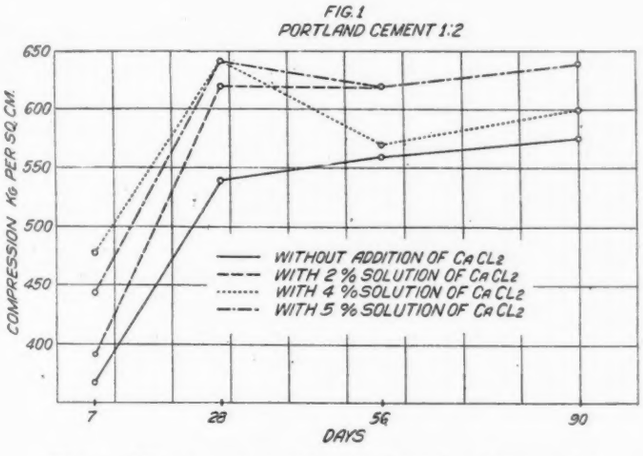


Fig. 1. Effects on strength of 1:2 portland cement by solutions of $CaCl_2$

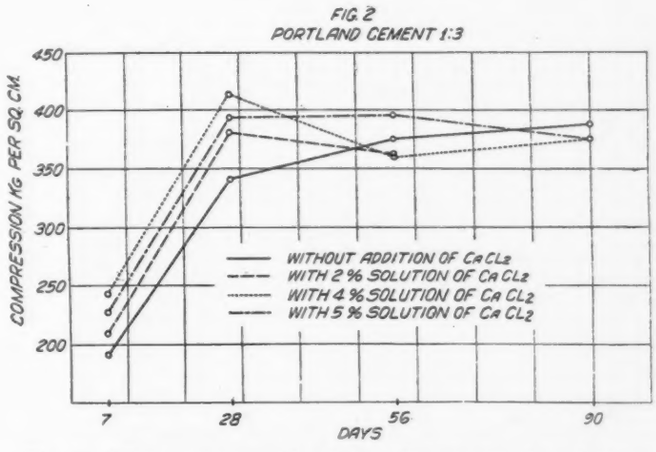


Fig. 2. Effects on strength of 1:2 slag cement by solutions of $CaCl_2$. (Note: The author evidently meant this diagram to refer to a 1:2 slag cement mix)

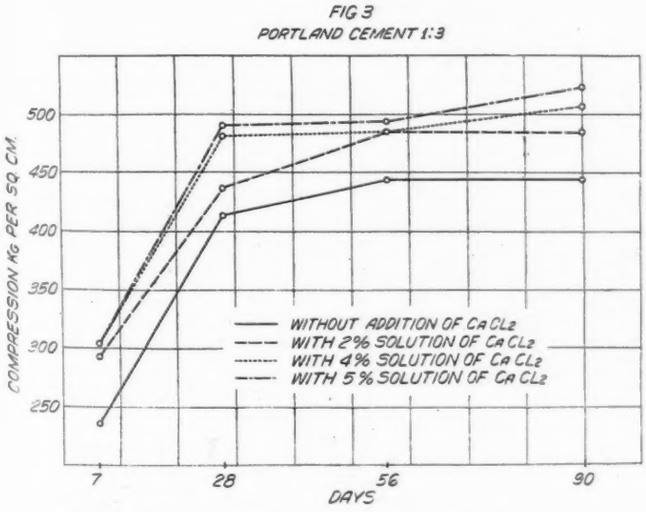


Fig. 3. Effects on strength of 1:3 portland cement by $CaCl_2$ solutions

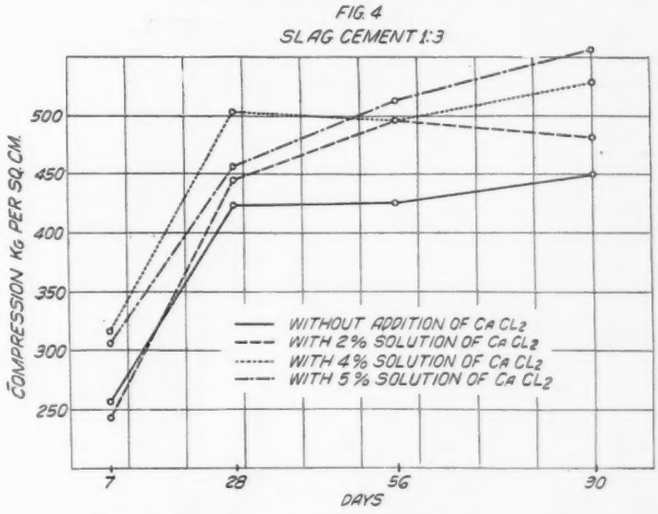


Fig. 4. Effects on strength of 1:3 slag cement by $CaCl_2$ solutions

greater solubility of lime in calcium chloride solutions. Nevertheless, it was my intention to find further ratification of this theory. This appeared possible, first, by recording the temperature rise during setting; second, by operating with two cements differing greatly in lime content, such as a portland and a slag cement, which in all physical requirements such as fineness, soundness and time of setting conformed to German specifications and had the following composition:

	Slag Cement, Pct.	Portland Cement, Pct.
SiO_2	29.06	21.93
Al_2O_3, Fe_2O_3	9.22	11.12
MnO	2.86	.....
CaO	52.73	63.01
MgO	3.17	0.95
SO_3	1.10	1.46
S	1.13	0.41
Loss on ignition	0.77	1.54
	100.04	100.42

FIG. 5
RISE IN TEMP. DURING SETTING OF PORTLAND CEMENT

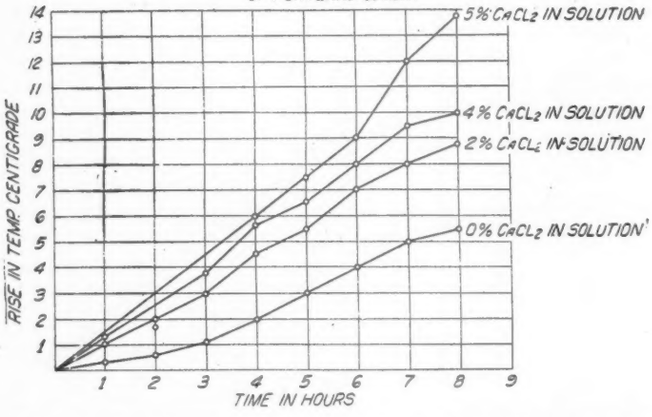


Fig. 5. Relative rise in temperature during setting period of portland cement treated with $CaCl_2$ solutions

0, 2, 4 and 5% $CaCl_2$ solutions were used as mixing water. The specimens were made of 1:3 mortar. The strength results are tabulated in Tables 5 and 6 and are plotted in Figs. 3 and 4.

TABLE V
1:3 Portland Cement Mortar

Mixing Water	Age at Test, Days	Compression kg. per sq. cm.	Tension kg. per sq. cm.
Pure water	7	238	25.8
	28 (combined curing)	416	46.3
	56	448	45.3
	90	447	44.4
2% $CaCl_2$ solution	7	294	25.5
	28 (combined)	436	47.9
	56	484	41.0
	90	488	38.0
4% $CaCl_2$ solution	7	304	26.0
	28 (combined)	478	43.1
	56	485	39.6
	90	506	37.9
5% $CaCl_2$ solution	7	304	25.0
	28 (combined)	484	47.3
	56	491	44.2
	90	520	41.8

TABLE VI
1:3 Slag Cement Mortar

Mixing Water	Age at Test, Days	Compression kg. per sq. cm.	Tension kg. per sq. cm.
Pure water	7	252	28.5
	28 (combined curing)	422	37.3
	56	425	35.6
	90	451	33.9
2% $CaCl_2$ solution	7	245	31.3
	28 (combined)	447	37.9
	56	496	36.7
	90	480	33.0
4% $CaCl_2$ solution	7	315	34.6
	28 (combined)	503	38.8
	56	498	38.9
	90	532	32.6
5% $CaCl_2$ solution	7	305	34.5
	28 (combined)	452	37.5
	56	512	35.2
	90	557	32.6

The results of these tests are evidently similar to those quoted above; however, they show essential differences in some respects. It is well known that unsoundness becomes first evident in the tensile test results, that further the limit of compression goes hand in hand with a certain brittleness of the concrete. For the pronounced retrogression of compressive strength and from the apparently higher resistance of slag cement we may conclude that the effect of calcium chloride depends to some extent on the lime content; however, these tests are not extensive enough and a great deal depends also upon the manner in which the specimens are made.

FIG. 6
RISE IN TEMP. DURING SETTING OF SLAG CEMENT

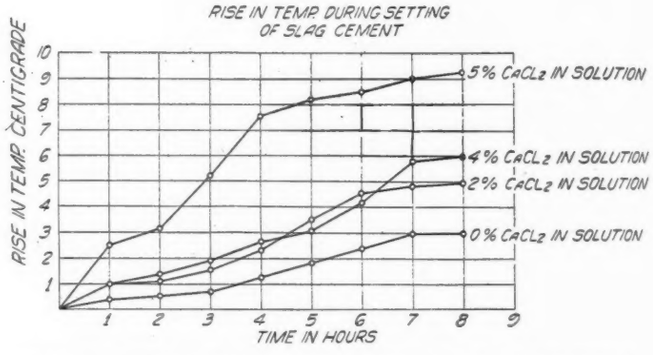


Fig. 6. Relative rise in tempreature during setting period of slag cement treated with $CaCl_2$ solutions

TABLE VII

Hours	Portland Cement 0 Pct.	2 Pct.	4 Pct.	5 Pct.	Slag Cement 0 Pct.	2 Pct.	4 Pct.	5 Pct.	$CaCl_2$
1	0.1	1.1	1.5	1.2	0.4	1.0	1.0	2.6	
2	0.3	1.9	2.0	2.0	0.4	1.1	1.2	3.2	
3	1.1	3.0	3.8	3.2	0.6	1.5	1.9	5.3	
4	2.0	4.5	5.5	6.0	1.1	2.6	2.6	7.6	
5	3.1	5.5	6.5	7.5	1.8	3.6	3.2	8.2	
6	4.0	7.0	8.0	9.0	2.4	4.3	4.2	8.6	
7	5.1	8.0	9.3	12.0	3.0	4.8	5.8	9.0	
8	5.6	8.9	10.0	13.9	3.0	4.9	5.9	9.2	
			Time of Setting: Hours and Minutes						
Initial		3:10	2:30	2:20	2:10	3:15	2:15	2:15	1:05
Final		5:05	4:10	3:30	3:00	6:25	4:15	4:10	3:10
Total		1:55	1:40	1:10	0:50	3:10	2:00	1:55	2:10
Room Temp., ° C.		20.5	22.0	21	22	20	19.5	21	21

In the tests which were to show the rise in temperature during setting use was made of Killig's thermo-apparatus. This is a calorimeter which—though it does not permit a record of absolute temperatures during the setting process—nevertheless gives an idea of the relative values obtained for the two cements thus making a comparison possible. Each test involved the use of a 1000 gm. sample of cement with 29% liquid, which was successively a 0, 2, 4 and 5% solution of calcium chloride. Table 7 gives the results of these tests. The data are plotted in Figs. 5 and 6. The temperature is given in degrees Centigrade.

The low rise in temperature recorded for the slag cement with a $CaCl_2$ admixture indicates its relation to the lime content of a given cement. It thus offers another proof of Killig's theory. This test also failed to show a radical change in time of setting, although a certain reduction was recorded. To obtain comparable results care was taken to keep the room temperature constant.

The argument that two commercial cements whose manufacturing processes differ cannot be easily compared may be correct in general; nevertheless, it is apparent enough in this case that the low-lime cement differs from the high-lime cement in accordance with our assumption. The increase in compressive strength recorded for slag cement is naturally a result of the effect of calcium chloride counteracting shrinkage by keeping the specimens moist.

It is quite certain and has been confirmed that the use of calcium chloride is beneficial to the soundness of cement mortars at early ages. According to Dr. Goslich,[5] Michaelis pointed out a number of years ago that calcium chloride might be a means for correcting unsoundness of underburned cement. However, at the time he was not aware of the fact that a dry admixture was to be avoided for reasons cited above.

It may be pointed out here for future tests, that only pure calcium chloride should be used, as, for example, the commercially available 70 to 75% $CaCl_2$ is adulterated with bleaching powder which has a strongly detrimental effect on cement.

The practical significance of calcium chloride admixtures is limited for the following reasons: First, the possible unfavorable results are not sufficiently clear; second, high early strength cements are now being manufactured as "special cements" and, third, the cost of calcium chloride prevents

(5) Zement, Charlottenburg 2, Knesebeck str. 74, Nov. 3, 1921.

its extensive application. A book by Busing-Schumann[6] points out the problem of using calcium chloride admixtures on concrete work in cold weather. Recent investigations of this problem by V. Frost[7] have shown that only in the presence of high calcium chloride admixtures does the freezing point of the mixing water become appreciably lowered to be of any practical significance. The use of such large amount of calcium chloride is not advisable.

These conclusions may show with special reference to my article recently published in Rock Products, entitled, "Problems in Cement and Concrete Research," that many a problem is still awaiting its ultimate solution; that each one of them could fill volumes and for that reason could only be briefly indicated within the limits of an article such as the above. The present article does in no way present a solution of the $CaCl_2$ problem and it is very possible that other reasons will be found for the peculiar behavior of cement in the presence of a $CaCl_2$ admixture. However, should it provide a stimulus for further research in this domain, its end will be fulfilled.

Missouri Awards Cement Contracts for 1926

THE Missouri State Highway Department has awarded contracts for 1,472,400 bbl. of cement to be used in construction work during 1926. There still remains to be awarded 144,300 bbl. The successful bidders and the approximate amounts awarded to each are as follows:

Pyramid Portland Cement Co., Des Moines, Iowa, 34,000 bbl.; Hawkeye Portland Cement Co., Des Moines, Iowa, 13,500 bbl.; Missouri Portland Cement Co., St. Louis and Sugar Creek, Mo., 313,050 bbl.; Marquette Cement Co., Cape Girardeau, Mo., 157,800 bbl.; The Great Western Portland Cement Co., Mildred, Kan., 384,250 bbl.; The Dewey Portland Cement Co., Dewey, Okla., 162,500 bbl.; The Ash Grove Lime and Portland Cement Co., Chanute, Kan., 164,550 bbl.; The Monarch Portland Cement Co., Humboldt, Kan., 123,750 bbl.; The Kansas Portland Cement Co., Bonner Springs, Kan., 106,500 bbl.; The Fredonia Portland Cement Co., Fredonia, Kan., 12,500 bbl.

The prices ranged from $2.32 to $2.95 per bbl. delivered on the work. These were subject to 40 cents discount for returns of sacks and a further discount of 10 cents for cash within 10 days. The average price is about $2.55 to $2.60 delivered. These prices are based on a mill net of about $1.75 without sacks in the Kansas City district and about $2.00 net without sacks in the St. Louis district. There was a price variation in the bids submitted for a number of points in Missouri of from 1 to 10 cents below the present net market.

(6) Der Portland-Zement, Verlag der Deutschen Bauzeitung, Berlin, 1912, p. 340.
(7) Teknisk Tidskrift, Vagd och Vattenbyggnadskonst, 1924, Vol. 1.

An interesting detail in connection with the cement letting was the fact that the bids were taken on a revised specification calling for 225 lb. tensile strength in 7 days instead of 200 lb. as stipulated by the Standard Specifications. The speifications also were revised to stipulate that unusual fluctuations in setting time resulting in finish troubles in the field would be cause for rejection. Out of fifteen companies bidding, twelve companies bid according to the specifications. Three companies refused to so bid, making the reservation that their bid was placed according to Standard Specifications. After considerable discussion, the three latter mentioned bids were rejected as irregular after the companies were given an opportunity to waive their exception to the specifications. The changes in specification were said to be considered necessary by the Department on account of the experience during the past season with cement from certain local sources of supply.

Signal Mountain to Erect Waste Heat Electric Generating Plant

PLAN for erection of a waste-heat boiler electric power plant at the plant of the Signal Mountain Portland Cement Co. of Chattanooga, Tenn., was approved at a recent meeting of directors. The matter was referred to the executive committee with power to act. The committee was thus given authority to begin the work, which will call for a half-million-dollar expenditure at such time as it deems necessary. Further action on the proposition is not expected for six months or more. All officers were re-elected at the annual stockholders meeting.

Plans for New Cement Plant for Alabama Completed

THE details of the plant to be erected at St. Stephens, Ala., by the Santa Rosa Cement Co. have been given out in a public statement by Ellis Soper of New York, engineer in charge of construction and design. Unofficial report on the proposed plant was published in Rock Products, December 26 issue, and incorporation notice in the January 9 issue. Mr. Soper says:

The Santa Rosa Cement Co. has been incorporated in Delaware for $8,500,000. Contract for the erection of the plant has been awarded to H. K. Ferguson Co. of Cleveland, Ohio. The plant to be built at St. Stephens, Ala., on the Tombigbee river will have a daily production of 5000 bbl. Power will at the beginning be supplied from the Alabama Power Co., but the design calls for the installation of waste heat boilers.

"Reinforced concrete silo storages of approximately 60,000 bbl. capacity each, together with a complete packing plant, will be built at Tampa, Mobile, and New Orleans. Bulk cement will be shipped direct to these distributing points from St. Stephens. Connections will be made with the Southern Railway at St. Stephens. The wet process will be used at the plant and operation expected to begin about November, 1926.

Sandusky Cement Celebrates Its 33rd Anniversary

THE thirty-third birthday of the Sandusky Cement Co., Cleveland, Ohio, was celebrated by "cementing the friendship" of the railroad men, who handle its products, at a banquet at the Hotel Clevland.

Executives and officers, representing fourteen steam railroads, which form the main part of the transportation system used by the company in shipping 18,000,000 sacks of cement from its four plants near Cleveland, were present.

"You're our bread and butter," said J. B. John, president of the cement company, in his address to his guests, "and we want to know you better."

The Sandusky Cement Co. was founded near Sandusky in 1893. It is now the largest cement manufacturing concern in Ohio and has plants in Illinois and New York.

The principal members of the organization are Cleveland men. Among them are J. B. John, president; Charles F. Brush, vice-president; William B. Newberry, assistant manager; E. J. Maguire, secretary-treasurer; A. T. McCormack, general sales manager; George W. Cole, traffic manager, and W. L. White, Jr., general superintendent.

The board of directors also included Frank Billings, J. H. Wade, A. C. Dustin, Dan P. Eells and E. S. Hanson, all of Cleveland.

A huge birthday cake, fashioned to represent a railroad engine pulling cars loaded with cement, was placed on one of the tables.

Eleven private railway coaches were used by the railroad men in returning to their homes.—*Cleveland (Ohio) News.*

Huron Portland To Be Exclusive Distributor of Ford Cement

THE affiliation of the interests in the sale and distribution of portland cement by which arrangement, effective February 1, the Huron Portland Cement Co., Detroit, Mich., becomes the exclusive sales agent for Ford portland cement produced at the Ford Motor Co.'s plant on the River Rouge, Detroit, Mich., has been announced recently by John W. Boardman, vice-president of the Huron Portland Cement Co.

Lower Gypsum Products Prices in 1925 Due to Increased Production

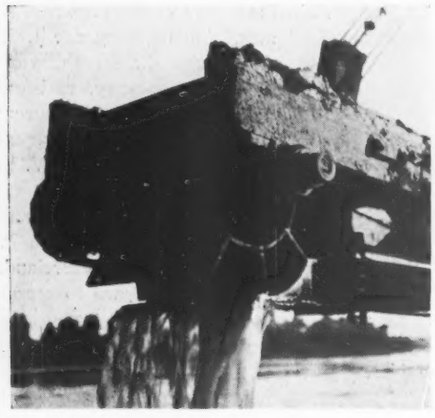
A STATEMENT in the *Chicago (Ill.) Economist* by Sewell L. Avery, president of the United States Gypsum Co., said 1925 business was the largest the company ever had, but that increased capacity has caused a reduction in prices.

Hints and Helps for Superintendents

New Device for Dredging Sand and Gravel

A NEW device is being tried out on one of the Kaw river dredges of the Stewart Sand Co. at Kansas City, Mo. It can hardly be classed as a "cutter" for it does not do the same work as the familiar rotary cutters or the traveling suction screen. Its main purpose is to keep the percentage of solids the same all the time that the pump is running. It might perhaps be best described as a suction feeder.

It consist of a paddle wheel with cast iron body and blades which revolves in front of the end of the suction pipe. The "bonnet" of the pipe has been taken off and replaced by a flattened outlet covered with bars. As the wheel revolves the paddles pick up the



Close-up of the feeder wheel

sand from the river bottom and throw it against these bars. Approximately the same amount is fed to the suction by each paddle and hence the solids in the pump discharge are always the same. The faster the paddle wheel is run the higher will be the percentage of solids.

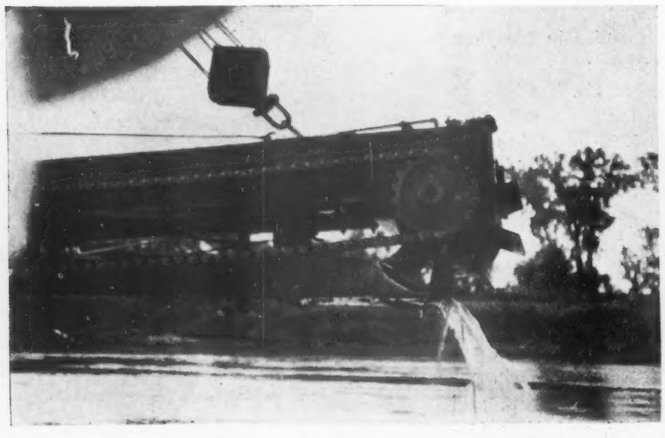
The wheel is not bothered by sticks as thick as a man's arm or even larger. It chops them up into pieces that pass through the pump easily. It cannot dispose of rocks in the same way but when a rock which is too large for the pump is picked up, the motor which drives the machine is automatically stopped. A reversing switch is thrown and the rock is thrown out by the back motion.

The paddle wheel is driven by chains and sprockets and a 25-h.p. motor on the deck of the dredge. The chain runs down one side of a "ladder" above the suction and the whole rigging weighs only 8 tons, so it is supported and handled by the ordinary A-frame that was used to support the suction pipe before the feeder was put on.

The machine is still in the experimental stage but promises to do well in certain sorts of ground. It would not be adapted to ground having many boulders that would not pass through the pump. It would seem to be especially adapted to relay pumps because it would insure a constant feed of both water and solids to the washing plant, which would permit of better washing and grading of the sand.

The inventor of the device is M. L. Thurston, who was formerly a mining engineer. He invented it for pumping tailings from a mining operation out of a lake in Ontario.

The suction feeding device attached to the dredge. It is not so heavy but that it can be handled by the ordinary hoist and A-frame used for handling the suction pipe



Left—The drive side of the device showing the chain and sprocket. Right—The other side. This view shows the shape of the bonnet on the sucton pipe. The inclined portion has a grizzly which keeps large pieces out of the pipe

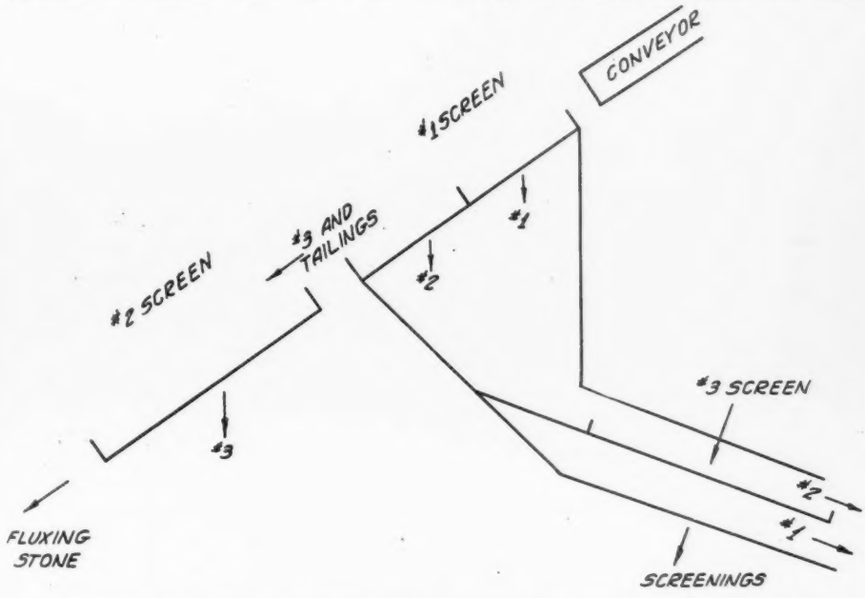
Vibrating Screens Exclusively for Crushing Plant

THE rock-crushing plant of the Chazy Marble Lime Co., Chazy, N. Y., burned last summer, and in replacing it, F. C. Wales, general manager, redesigned the entire screening layout, so as to eliminate the customary cylindrical screens. As this plant produces furnace flux as well as commercial crushed stone, it is unusually interesting.

The original plant had a single 42-in. by 24-ft. revolving cylindrical screen, dust-jacketed, which produced commercial sizes below 3-in. and flux stone (3- to 7-in.) by rejections. The crusher is a 22x30-in. jaw crusher.

The present method of screening using Hum-mer vibrating screens exclusively is shown in the accompanying diagram. The No. 2 screen has 3-in. square mesh. The rejections are furnace flux. The No. 1 screen removes No. 1 and No. 2 stone (New York State Highway Department standards). The No. 3 screen below separates these two sizes and removes the screenings. A non-binding wire-cloth covers the lowest screen. The No. 2 screen removes the No. 3 stone and rejects the flux stone or over size.

About 350 tons per 9-hour day has been produced, but the capacity is estimated at 500 tons.



Screening layout of the Chazy Marble Lime Co. crushing plant utilizing vibrating screens exclusively

More About Car Dipping Tank

IN our "Hints and Helps," January 9, 1926, p. 49, we described a car-dipping tank at the plant of the Omaha Cast Stone Co., Omaha, Neb. This tank contains oil and is used to dip the cars on which the cement products are given a steam curing. It could be used with equal advantage as a preservative treatment for the cars used in sand-lime brick manufacture.

A. G. Swanson, general manager of the Omaha Cast Stone Products Co., kindly contributes the additional informaiton about the tank and the process:

"This vat is quite successful in dipping industrial cars where they are subjected to steam as in our plant as no paint will withstand the effects of steam. We dip them quite often and we find it is a great retarder in the deterioration of the raw iron.

"Should we have occasion to build another of these dipping vats, we would build it differently. Instead of using a hoist to lift the cars in and out, we would slope the entrance which would have a concrete floor and drive, and merely let them run into the oil and pull them right out. This would shorten up the labor operation involved."

Replacing Worn Shovel Engine

ORDINARY belief is that it does not pay to replace old engines with other makes of new engines. The experience of the Miller Burke Construction Co. of Los Angeles, Calif., with the replacement of a worn engine on a small revolving steam shovel disproves that belief. The Climax Co. of Los Angeles undertook the job at a price of $218 plus $86 for two new gears. The method of installing the new model "K" Climax engine was as follows:

The heavy cast-iron base was used by planing some metal off the top and adding two 3x3x½-in. steel angles to carry the new engine. The angles were left long enough to extend forward and carry the radiator, also, and everything properly lined up with the outboard bearing at the rear.

By making a few mechanical changes, a worn shovel engine can be replaced by a new and different type of engine

New pinion and idler gears were supplied, and an extension added to the starting crank so the engine could be started from outside the cab.

One of the most interesting things done was to change one of the boom truss-rods in order to avoid the front cylinder of the engine. This is the rod showing near the radiator in the accompanying photograph. A piece was welded into this rod, a bond made to dodge the engine, and a brace made of 3-in. extra heavy pipe, also showing in the picture, placed between the bend and the floor alongside the engine. This holds the truss-rod firm and gives plenty of room for the new engine.

Oil tank for dipping cars

Superintendents

WE'LL pay you $5 for every good idea —photograph, pencil sketch, blueprint, or letter, out of which we can build a "Hints and Helps." Several plant superintendents are receiving these $5 checks for their suggestions. Why not send your "Hint" along?

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

(These are the most recent quotations available at this printing. Revisions, corrections and supplemental information will be welcomed by the editor.)

Stock	Date	Par	Price bid	Price asked	Dividend rate
Alpha Portland Cement Co. (common)**	Feb. 3	100	128	131	1¾% quar. 25% ex. Dec. 1
Alpha Portland Cement Co. (preferred)**	Feb. 3	100	109	.....	1½% quar. Sept. 1
Arundel Corporation (sand and gravel—new stock)	Feb. 1	No par	34	34	30c quar., 60c ex, Jan. 2
Atlas Portland Cement Co. (common)	Feb. 3	No par	51	54	50c quar.
Atlas Portland Cement Co. (preferred)	.....	100	.....	.....	2% quar. Oct. 1
Atlas Portland Cement Co. (preferred)**	Feb. 3	33⅓	44	46	2% quar. Oct. 1
Bessemer Limestone and Cement Co. (common)‡	Feb. 1	100	145	160	1½% quar. Jan. 1, 4% ex. Jan. 1
Bessemer Limestone and Cement Co. (preferred)‡	Feb. 1	100	107½	109	1¾% quar. Jan. 1
Bessemer Limestone and Cement Co. (convertible 8% notes)‡	Feb. 1	.....	120	130	8% annual
Boston Sand and Gravel Co. (common) (r)	Jan. 30	100	61	.....	2% quar. July 1
Boston Sand and Gravel Co. (preferred) (d)	Jan. 15	.....	.....	80	1¾% quar. Oct. 1
Boston Sand and Gravel Co. (1st preferred) (d)	Jan. 15	.....	.....	90	2% quar. Oct. 1
Canada Cement Co., Ltd. (common)	Feb. 3	100	106	106¼	1½% quar. Jan. 16
Canada Cement Co., Ltd. (preferred) (f)	Jan. 29	100	117½	119½	1¾% quar. Feb. 16
Canada Cement Co., Ltd. (1st 6's, 1929) (f)	Jan. 29	.....	102½	103½	3% semi-annual A&O
Canada Crushed Stone Corp., Ltd. (6½s, 1944) (f)	Jan. 29	100	93	96	
Charles Warner Co. (lime, crushed stone, sand and gravel)	Jan. 30	No par	23	25	50c quar. Jan. 11
Charles Warner Co. (preferred)	Jan. 30	100	100	102	1¾% quar. Jan. 28
Charles Warner Co. (lime, crushed stone, sand and gravel) 7s, 1929 (r)	Jan. 30	100	105	.....	
Cleveland Stone Co.	Feb. 3	.....	132	150	1½% quar., 1% ex. Dec. 1
Connecticut Quarries Co. (1st Mortgage 7% bonds) (s)	Jan. 30	100	103	.....	
Coplay Cement Mfg. Co. (common) (4)	Dec. 16	.....	12½	.....	
Coplay Cement Mfg. Co. (preferred) (1)	Dec. 30	.....	70	.....	
Dolese and Shepard Co. (crushed stone) (a)	Feb. 3	50	75	75¾	$1.50 quar. Jan. 1
Eastern Brick Corp. (7% cum. pfd.) (1)	Dec. 9	10	40c	.....	
Eastern Brick Corp. (sand lime brick) (common) (1)	Dec. 9	10	40c	.....	
Edison Portland Cement Co. (common)	Nov. 3	50	7½c(x)	.....	
Edison Portland Cement Co. (preferred)	Nov. 3	50	17½c(x)	.....	
Giant Portland Cement Co. (common)**	Feb. 3	50	40	44	
Giant Portland Cement Co. (preferred)**	Feb. 3	50	48	52	3½%s.-a. Dec. 15, plus 10% arrears
Ideal Cement Co. (common)‖	Feb. 3	No par	80	85	$1 quar. Jan. 2. 50c ex. Dec. 27
Ideal Cement Co. (preferred)‖	Jan. 30	100	106	108	1¾% quar. Jan. 2
International Cement Corporation (common)	Feb. 1	No par	68⅜	71⅞	$1 quar. Dec. 31
International Cement Corporation (preferred)**	Feb. 1	100	105¼	106	1¾% quar. Dec. 31
International Portland Cement Co., Ltd. (preferred)	Mar. 1	.....	30	45	
Kelley Island Lime and Transport Co.	Feb. 3	100	120	125	$2 quar. $2 ex. Jan. 2
Lawrence Portland Cement Co.**	Feb. 3	100	110	.....	2% quar.
Lehigh Portland Cement Co.‖	Feb. 3	50	90	92	1½% quar.
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, expire serially up to 1930) (k)	Jan. 29	100	99	100	
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, expire serially from 1930 to 1935) (k)	Jan. 29	100	97½	100	
Michigan Limestone and Chemical Co. (common)‖	Jan. 30	.....	24	.....	
Michigan Limestone and Chemical Co. (preferred)‖	Jan. 30	.....	24	.....	1¾% quar. July 15
Missouri Portland Cement Co.	Feb. 3	25	63½	64½	50c quar. Feb. 1
Missouri Portland Cement Co. (serial bonds)	May 29	.....	104½	104½	3¼% semi-annual.
Monolith Portland Cement Co. (common) (c)	Jan. 28	.....	9	9½	
Monolith Portland Cement Co. (units) (c)	Jan. 28	.....	24½	26	
Monolith Portland Cement Co. (preferred) (c)	Jan. 28	.....	7¼	8¼	
Newaygo Portland Cement Co.*	Jan. 29	.....	120	.....	
New England Lime Co. (Series A, preferred) (i)	Jan. 29	100	96½	99	
New England Lime Co. (Series B, preferred) (i)	Jan. 29	100	96½	99	
New England Lime Co. (V.T.C.) (i)	Jan. 29	.....	23	25	
New England Lime Co. (6s, 1935) (m)	Jan. 29	100	98	100	
North American Cement Corp. 6½s 1940 (with warrants)	Feb. 3	.....	99	99	
North American Cement Corp. (units of 1 sh. pfd. plus ½ sh. common) (z)	Nov. 27	.....	94	99	2 mo. period at rate of 7%
North American Cement Corp. (preferred)	Dec. 31	.....	.....	.....	1.75 quar. Feb. 1
Olympic Portland Cement Co. (g)	Oct. 13	.....	.....	£1⅝	
Pacific Portland Cement Co., Consolidated ($)	Jan. 28	100	89¾	90	½% mo.
Pacific Portland Cement Co., Consolidated (secured serial gold notes)§	Jan. 28	.....	100	100½	3% semi-annual Oct. 15
Peerless Portland Cement Co.*	Jan. 29	10	6½	7	
Petoskey Portland Cement Co.*	Jan. 29	10	10	.....	1½% quar.
Phosphate Mining Co. (1)	Nov. 25	.....	1@5	.....	
Pittsfield Lime and Stone Co. (preferred)	.....	100	.....	.....	2% quar. Apr. 1
Rockland and Rockport Lime Corp. (1st preferred) (d)	Feb. 1	100	95	96	3½% semi-annual Feb. 1
Rockland and Rockport Lime Corp. (2nd preferred) (d)	Jan. 15	100	.....	70	3% semi-annual Feb. 1
Rockland and Rockport Lime Corp. (common) (d)	Feb. 1	No par	.....	60	1½% quar. Nov. 2
Sandusky Cement Co. (common)*	Jan. 18	100	125	130	$2 quar. $3 ex. Dec. 31
Santa Cruz Portland Cement Co. (bonds) ($)	Jan. 28	.....	104	106	6% annual
Santa Cruz Portland Cement Co. (common) ($)	Jan. 28	50	80	100	$1 quar. $1 ex. Dec. 24
Simbroco Stone Co. (pfd.)	Dec. 12	.....	.....	.....	$2 Jan. 1
Superior Portland Cement, Inc. (new stock) (6)	Jan. 19	.....	45	.....	
Tidewater Portland Cement Co. (common) (3)	Nov. 25	.....	8½	.....	
United States Gypsum Co. (common)	Feb. 3	20	155	155¾	2% quar. Dec. 31, $2 plus 15% stock ex. Dec. 31
United States Gypsum Co. (preferred)	Feb. 3	100	115	115	1¾% quar. Dec. 31
Universal Gypsum Co. (common)†	Feb. 3	No par	20¾	22	
Universal Gypsum V. T. C.†	Feb. 3	No par	18¾	19½	
Universal Gypsum Co. (preferred)†	Aug. 5	.....	76	.....	1¾% quar. Sept. 15
Universal Gypsum Co. (1st mortgage 7% bonds)†	Feb. 3	.....	99	(at 6½%)	
Union Rock Co. (7% serial gold bonds) (y)	Jan. 28	100	100	102	
Vermont Milling Products Co. (slate granules) 5 sh. pfd. and 1 sh. com. (2)	Dec. 30	.....	$1 fo the lot	.....	
Wabash Portland Cement Co.*	Aug. 3	50	60	100	
Winchester Brick Co. (preferred) (sand lime brick) (5)	Dec. 16	.....	10c	.....	
Wisconsin Lime and Cement Co. (1st Mort. 6s, 1940) (o)	Jan. 2	100	98½	100	
Wolverine Portland Cement Co.	Feb. 3	10	7½	7½	2% quar. Aug. 15

*Quotations by Watling, Lerchen & Co., Detroit, Mich. **Quotations by Bristol & Willett, New York. †Quotations by True, Webber & Co., Chicago. ‡Quotations by Butler, Beadling & Co., Youngstown, Ohio. §Quotation by Freeman, Smith & Camp Co., San Francisco, Calif. ‖Quotations by Frederic H. Hatch & Co., New York. (a) Quotations by F. M. Zeiler & Co., Chicago, Ill. (b) Quotations by De Fremery & Co., San Francisco, Calif. (c) Quotations by A. E. White Co., San Francisco, Calif. (d) Quotations by Lee, Higginson & Co., Boston, Mass. (f) Nesbitt, Thomson & Co., Montreal, Canada. (g) Neidecker and Co., Ltd., London, England. (i) E. B. Merritt & Co., Inc., Bridgeport, Conn. (k) Peters Trust Co., Omaha, Neb. (m) Second Ward Securities Co., Milwaukee, Wis. (o) Central Trust Co. of Illinois, Chicago, Ill. (r) J. S. Wilson Jr. Co., Baltimore, Md. (s) Chas. W. Scranton & Co., New Haven, Conn. (x) Price obtained at auction by Barnes and Lofland, Philadelphia, on Nov. 3, 1925. (y) Dean, Witter & Co., Los Angeles, Calif. (z) Hemphill, Noyes & Co., New York. (1) Price obtained at auction by Adrian H. Muller & Sons, New York. (2) Price obtained at auction by R. L. Day & Co., Boston. (3) Price obtained at auction by Weilepp-Bruton & Co., Baltimore, Md. (4) Price obtained at auction by Barnes and Lofland, Philadelphia, Pa. (5) Price obtained at auction for lot of 50 shares by R. L. Day & Co., Boston, Mass. (6) Quotations by Bond & Goodwin & Tucker, Inc., San Francisco.

Editorial Comment

The Public And Highways

We have no sympathy with, nor can we get the point of view of, those cheerful prophets who see an approaching end of highway construction. We thoroughly agree with John Rice, past-president of the National Crushed Stone Association, who comes from the conservative East, where highway building will stop first, if it ever stops anywhere, who is a man of well seasoned experience, not given to indulging in meaningless superlatives, and whose judgment is based on a thorough knowledge and understanding of economics as well as of business. At the recent Montreal convention of the association, Mr. Rice said:

I am inclined to believe the industry may enjoy a prolonged prosperity, because of my faith in the continuance of highway construction, which consumes so large a portion of our output; and my belief in this is founded on the fact that present motor-car license fees and gasoline taxes are adequate to bear the expenses of maintenance and amortize the cost of construction. Since there seems to be no opposition to this form of taxation on the part of motorists, and they are a very substantial and influential portion of the electorate, there is little objection to be expected from other parties; and, therefore, in my opinion, road building will proceed enthusiastically for a good many years to come, notwithstanding the fact that the annual expenditure runs into billions of dollars in the United States.

That is the clearest and most logical reason why road building will continue indefinitely that we have ever heard, or seen in print. All of us must know and realize that while the tax burden on the motor car owner, in the aggregate, is enormous, there is seldom raised a voice against it. No money is more cheerfully given by taxpayers than that which they know goes directly into the improvement of public roads. Let government officials and politicians take due note of this attitude of the public, which never begrudges money expended for permanent public works.

From another source comes a vision of the public's attitude toward the future of highway construction. The editorial below from the Chicago *Tribune* of January 27 is interesting and inspiring:

BROAD HIGHWAYS

A dozen townships, five counties, two states, and the federal government have combined forces to put through the first through highway contemplated in the regional improvement schedule drawn up for the Chicago transportation zone. The new road, which is in reality the improvement and linking up of existing roads, will connect Kenosha, Wis., with Kankakee, Ill., passing through Chicago via Western avenue and through 32 towns and cities.

To the Chicago Regional Planning Association is due the credit for combining all the forces which will make the new highway possible. The vision of the men who foresaw that Chicago and the region about the city must plan together as a unit is vindicated.

The talk of these regional planners sounded grandiose a few years ago, when they contemplated the unified improvement of an area with a radius of 50 miles. Since then they have justified their prophecies. The big figures of yesterday are commonplace now. James T. Voshell, United States highway engineer, declares pavements 44 feet wide are not wide enough. Not long ago nine feet was wide enough; then it grew to 18. Now the planners contemplate a 60-foot width without gasping.

Such highways, surely, must be built if the Chicago area is to have adequate transportation. The new route, which will provide a direct road between Green Bay on the north and Danville on the south, must be only the first of many more such. The coming spring and summer will see still more passenger cars and trucks on the roads. There has been talk about the automobile saturation point being close at hand. That point is far away still, if the estimated output of 4,200,000 motor vehicles in 1925 is any indication.

The necessity is for roads, through roads, broad roads, well paved, so built as to make speed and safety possible at the same time.

"Doping" Road Bases

The Bureau of Public Roads and the California State Highway Department have made extensive experiments in "doping" clay road bases to prevent swelling and shrinking with varying moisture contents of the clayey soil. Both are agreed that this method is neither efficient nor economical. Both are further agreed that a cushion of sand (or fine stone or gravel) will be both efficient and economical in establishing stability in road bases of heavy soil.

Concerning this method, the California Highway Department says in its report:

A sand or gravel layer is an efficient and economical method of minimizing damage to pavement, resulting from swelling or shrinkage of the subsoil.

And the Bureau of Public Roads says in its report:

It is believed that a better treatment (than doping with lime or cement) of heavy soil subgrade is:

1. To use a sand cushion to act as an equilibrant to run into irregularities of the subgrade, which is deformed by shrinkage or swell of the soil, and thus to maintain a uniform surface in contact with the base of the pavement, or
2. To establish an unchanging moisture content in the immediate subgrade.

The theory on which the doping system was based appears to be correct but it did not work out in practice. For one thing the treatment would probably have to be carried to a greater depth than it was carried to in the field test, and for another the quantity of lime or cement used would have to be much greater in some soils than in others, so much greater that the cost would be prohibitive. The object sought is drainage, consequently a cemented or compacted mat of stone as in a macadam road is not desirable.

An Appreciation of T. R. Barrows

By JOHN PRINCE
For Three Years President of the National Sand and Gravel Association

THROUGH death we have lost T. R. Barrows, the executive secretary of our National Sand and Gravel Association, but his influence in creating a national view-

T. R. Barrows, Executive-Secretary, National Sand and Gravel Association, who died in Atlanta, Ga., on January 31, 1926

point in this industry will go on so long as many of us remain.

Five years ago Mr. Barrows came to the association as the editor of our monthly bulletin, and throughout his service the *Bulletin* was peculiarly himself.

For less than a year was he permitted to devote his energies exclusively to this work. Then it became necessary for him to undertake the larger duties of executive secretary. These larger responsibilities he undertook with regret, but he applied to them a keen business judgment and the utmost devotion with increasing credit to himself and value to the industry.

Barrows came to us as a trained newspaper man and writer of exceptional ability. We were then in the midst of the depression which came late in 1920. As is so frequently the case, this brought a measure of demoralization to our business and our association. Many state associations discontinued with the resultant loss in membership and revenue to the national association. Further, we were burdened with debt incurred in our efforts to control increasing freight rates. Into this rather gloomy picture came Barrows, first as editor and then as executive secretary.

Throughout his time he was always and first the editor of the *National Sand and Gravel Bulletin*. He made this magazine an able instrument for the improvement of our industry and brought it to the front, recognized as the best periodical published by any trade association in the country. Its influence, particularly among producers, has been marked.

He brought to his work the personality of an artist in that he was concerned only in the work itself, the accomplishment, never in the reward. The 60 issues of the bulletin which he managed some way to prepare in spite of the long hours and constant demand on his time in other directions will be a permanent memorial to him. True to the artistic type, he was always his own most severe critic, and in spite of many letters of appreciation in the files of the Washington office, he could always see ways to improve and reasons to regret the lack of perfection.

Under his direction, the association gradually increased its membership, its influence and worked its way to a position of financial solvency. His principles of economy he applied equally to himself and the other agencies of the association. Few not officially connected with the association can realize the time and the effort required where to get results, and carry on activities, membership and money must first be secured, and these in turn are dependent on first having accomplishments to show.

For four years, Mr. Barrows successfully met this situation. Fortunately, for the past year, he had seen both membership and accomplishments result from his efforts.

Truly, Tom Barrows gave his life for his ideals. In spite of the efforts of his friends, he demanded of himself long hours, constant work, and no relaxation. Those of us who saw him last at Atlanta now realize that these demands he made on himself left him no reserve to meet the illness that came upon him during the convention.

To all of us who knew him during these five years, the ability of the man and his natural dignity commanded a respect and recognition not soon to be forgotten.

Idaho Phosphate Company Sold to McIlwee Interests

HOLDINGS of the Idaho Phosphate Co., Paris, Idaho, were sold at sheriff's sale Saturday for mortgage bonds to the McIlwee interests of Salt Lake City, Utah, which are controlled by J. A. McIlwee, who was president of the Idaho Phosphate Co. and original owner and promoter of the old company. At the same time an option was taken on the Bear Lake Phosphate Co.'s holdings by the McIlwee interests who propose to merge the two properties, which adjoin each other and operate them as one, making the largest phosphate company in the west. Both properties contain the black and grey vein, which are rated very high in phosphate.

The estate of the Idaho Phosphate Co. comprises an area covering two and a half miles of the phosphate vein. That of the Bear Lake Phosphate Co., lying immediately north of the Idaho Phosphate Co.'s ground embraces two miles of the lode, conceded to be one of the greatest phosphate deposits in the world. If the two properties are consolidated, the McIlwee interests will control four and a half miles of choice territory in the heart of the greatest phosphate district in the world.

The Idaho Phosphate Co. is well equipped A tunnel has been driven 3000 ft. on the vein and approximately 100,000 tons of phosphate has been shipped. In addition to compressors, drills and machinery, the company has buildings sufficient to accommodate 150 men, machine and blacksmith shops, and a mill for crushing, drying and pulverizing the rock preliminary to shipping. Transportation facilities are ideal, as a four-mile standard gauge railroad leads from Paris to the property three miles away.

The mill operated in connection with the mine has a crushing capacity of 500 tons per day. It has five rotary drying kilns of 100 tons a day capacity. A Raymond pulverizer with a capacity of five tons an hour produces finely ground raw rock phosphate pulverized of mines 100 mesh.

The Idaho Phosphate property has been developed by an adit tunnel 200 ft. long, and incline shaft to a depth of 208 ft., both the shaft and tunnel have been driven on the gray vein; the tunnel and shaft proves the continuation of the phosphate. This development gives a tonnage of approximately 100,000 tons in sight. Government engineers estimate that the phosphate continues for a depth of 2000 ft. or more. At this figure, a very conservative estimate of the speculative tonnage, would be over four million tons. This is on the gray vein only; considering the Bear Lake property, and the black vein on both properties, this would give a speculative tonnage of millions of tons of very high grade phosphate within the immediate vicinity of Paris.

"The outlook for the phosphate industry is excellent," said J. A. McIlwee. Inquiries indicate that phosphate demand should open up rapidly."

"By sinking a shaft 400 ft. deep in Paris canyon we can mine the vein both in the Idaho Phosphate and the Bear Lake property as well, at a considerably greater depth than has been previously attained and ship from 500 to 1000 tons of phosphate rock daily."—*Paris (Idaho) Post.*

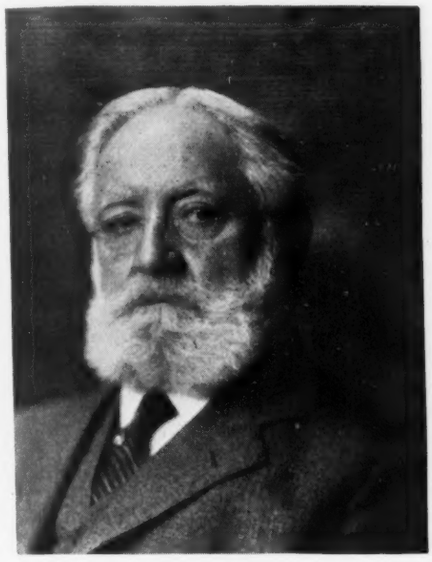
Construction Materials Company Adds New Scow

A NEW wooden scow built by the employes of the Construction Materials Co. of Chicago and to be used to carry gravel from the Bass river beds to the Ferrysburg, Mich., plant was recently launched at Grand Haven, Mich. The new scow is 120x30 ft., with 4-ft. draft and capacity of 300 cu. yd.—*Grand Haven (Mich.) Tribune.*

William Dickinson

WE reprint below the official announcement of the Portland Cement Association on the death of William Dickinson, one of their oldest and most esteemed members:

"With feelings of deepest regret we have received announcement of the death of William Dickinson, vice-president of the Marquette Cement Manufacturing Co., who died at his winter home at Redlands, Calif., January 27, 1926, following an illness of two months.



William Dickinson

"Immediately on receipt of this sad news, President Blaine S. Smith of the Portland Cement Association sent the following telegram:

Mrs. Wm. Dickinson
704 West Highland Avenue
Redlands, Calif.

"Personally and on behalf of the members of the Portland Cement Association, I extend our heartfelt sympathy in your great loss. Mr. Dickinson's fine traits of character and delightful personality have through his long connection with the industry made him countless friends. All of them feel a deep and genuine grief at his going.—

"President Smith has appointed the following committee, consisting of the executive committee, the general manager of the association, and representatives of member companies having offices in Chicago, to represent the association at the funeral: John W. Boardman (Huron-Wyandotte), L. R. Burch (Atlas), C. A. Irvin (Alpha), F. W. Kelley (North American), Blaine S. Smith (Universal), E. M. Young (Lehigh), L. E. Greer (Manitowoc), D. H. MacFarland (Atlas), B. H. Rader (Lehigh), John L. Senior (Peninsular), Wm. M. Kinney (Association).

"The funeral was held Monday, February 1, at the Fourth Presbyterian Chapel, 126 East Chestnut Street, Chicago. Interment will be at Graceland cemetery.

"William Dickinson was born in Hadley, Mass., November 3, 1848. He came to Chicago in 1860, at the age of twelve. He was educated in the Chicago public schools, graduating from West Division high school.

"His business career began in Chicago in association with Phillip Wadsworth, on Market Street, who operated the Empire Warehouse Co. According to the "History of the Portland Cement Industry in the United States," this was in 1873. In reminiscing about the early days of the portland cement industry in the United States, Mr. Dickinson in the History of the Industry mentions that the Empire Warehouse Co. purchased 250 barrels of portland cement from an importation which came from Europe by way of Montreal to Chicago. The product was so new and untried in the middle west that finding purchasers was difficult, but sale was consummated to the John V. Farwell Co., wholesale dry goods merchants, who at that time were planning a new building. This was the first portland cement used in the middle west. More of Mr. Dickinson's early experiences in the marketing side of the industry will be found on pages 46 and 47 of the "History of the Portland Cement Industry in the United States."

"Later the firm of Dickinson Bros. & King, composed of William and John Dickinson of Chicago, and Jerome A. King, was organized. This firm was active for many years in the warehousing and selling of cement and no doubt led to Mr. Dickinson's entry into the manufacturing of portland cement.

"In 1898, the Marquette Cement Co. (now Marquette Cement Manufacturing Co.), of which Mr. Dickinson was vice-president at the time of his death, was organized. The following year the company began manufacturing with a capacity of 250 bbl. per day.

"Mr. Dickinson was always one of the association's most active and enthusiastic supporters, being a regular attendant at our meetings. As one of the pioneer cement manufacturers, he was widely known throughout the industry. His strong personality and genial disposition made him a wide circle of admiring friends.

"Mr. Dickinson was a member of the Union League and Evanston golf clubs. In addition to his widow, he is survived by two children, Woodbridge Dickinson and Mrs. Max Hoffman, by his brothers, Theodore G. and John W. Dickinson and by his nephew Robert B. Dickinson."

Adelmer Marcus Bates

ADELMER MARCUS BATES, president of the Bates Valve Bag Co. of Chicago, died from heart failure while walking in 47th street, New York City, on January 21. He was born in 1868 in Iowa Falls, Iowa, and was the third son in a family of seven sons and three daughters.

When four years of age, his father moved from Iowa Falls to Adams county, Wisconsin, traveling in a covered wagon. Mr. Bates was educated in the public schools, working during vacations on his father's farm.

He entered Shattuck Military School at Fairbault, Minn., working his own way through the school by selling newspapers and dealing in coal and selling insurance.

From 1894 to 1899 he lived in Chicago and was employed by the Worcester Salt Co. as a traveling salesman. By exceptional ability and industry and with extraordinary success as a sales manager he was instrumental in greatly increasing the business of that company.

He was forcibly struck by the crude methods employed by the salt companies in filling their small packages of table salt and while pondering over the problem of how improvement could be made in these methods, in the year 1899, he was seized with the idea of the feasibility of a self-closing bag. It was in the evening hours at the Hyde Park Hotel in Chicago, after a hard day's work, that he made the first cloth valve bag, the generic invention which was the basis of his future success.

Years of hard work and trying experiences followed in developing machinery for the filling of such a bag. His first work was at the salt works of the Joy Morton Co. at the mouth of the Chicago river. A successful machine was designed which was, after repeated failures, subsequently used in nearly every salt plant throughout the United States.

He then turned his attention to the development of machines for filling valve bags with cement, plaster and other rock products. After several years of experimentation a machine was evolved that filled the bag, weighed the contents, automatically cut off the flow of material and discharged the filled bag from the machine to a traveling belt that carried it to the car door. This machine was so efficient that it won its way rapidly into all the cement mills, plaster mills and hydrated lime plants of the United States and Canada. By its use four men were enabled to fill, weigh, close and place in the car 12,000 95-lb. bags of cement in a working day, an accomplishment unheard of previously in packing cement.

In 1907 every cement and plaster bag was tied at the open end by the use of jute string. With great energy Mr. Bates threw his efforts into the task of converting the cement companies to the new method of closing their cloth bags with wire. A new wire tie was invented and new ingenious automatic machinery for manufacturing the tie was engineered, with the result that every cement and plaster cloth bag in the United States is now closed with a wire tie.

Mr. Bates leaves a widow, two sons, Mark C. Bates and George A. Bates, and one daughter, Isabel. He was a member of the South Shore Country Club, Flossmoor Country Club, Olympia Fields Country Club, Lehigh Valley Country Club of Allentown, Penn., Toledo Club of Toledo, Ohio, Livingston Club of Allentown, Penn., the Union League Club of Chicago and the Inverness Club of Toledo, Ohio.

Traffic and Transportation

By EDWIN BROOKER, Consulting Transportation and Traffic Expert
Munsey Building, Washington, D. C.

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week beginning February 3:

Central Freight Association Docket

12305. Crude or raw dolomite and fluxing stone. Carloads, Carey and McVittys, Ohio, to Buffalo and Dunkirk, N. Y. Present rate, $1.89 per gross ton; proposed, $1.79 per gross ton.

12318. Stone dust. Carloads, Piqua, Ohio, to Huntingburg, Ind. Present rate, $3.02 per net ton; proposed, $2.16 per net ton.

12320. Sand, viz.: Blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding and silica. Carloads, points within Canton group to Pittsburgh, Penn. Present rate, $1.76 per net ton; proposed, $1.51 per net ton.

12323. Gravel and sand, other than blast, engine, foundry, glass, molding or silica. Carloads, from siding of the East Liverpool Sand Co. (east of Leetonia, Ohio) to Malvern, Ohio (P. R. R.) and Lisbon, Ohio (P. L. & W.). Present rate, $1 and $1.01 per net ton; proposed, 80 cents per net ton to Mavern, Ohio (P. R. R.) and 90 cents per net ton to Lisbon, Ohio (P. L. & W.).

12324. Gravel and sand (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica). Carloads, Ambridge, Baden, Freedom and Neville Island, Penn., to Cokeburg, Penn. Present rate, Ambridge, Penn., 14 cents; Baden and Freedom, Penn., 15 cents; Neville Island, Penn., 14 cents. Proposed, $1.25 per net ton.

12361. Gravel and sand (other than blast, engine, foundry, glass, molding or silica). Carloads, Ambridge, Baden, Freedom, Neville Island, Penn., to Brier Hill, Penn.

From	Proposed Rate	Present Rate
Ambridge, Penn.	$1.40*	$.16†
Baden, Penn.	1.40*	.17†
Freedom, Penn.	1.40*	.17†
Neville Island, Penn.	1.40*	.16†

*Rate in cents per ton of 2000 lb.
†Rate in cents per 100 lb. (sixth class).

12379. To apply on sand other than bank, glass, molding, silica, blast, core, engine, filtering, fire or furnace, foundry, grinding or polishing or loam sand. Carloads, rate of 75 cents per net ton from Cayuga, Ind., and 80 cents per net ton from Summit Grove Group, Ind., to Chicago, Chicago Heights, Momence, St. Anne and Watseka, Ill. Proposed rates to Chicago to apply only for C. & E. I. delivery, no change to be made in rates applying for connecting line deliveries.

To	From Cayuga. Present	Proposed
Chicago	$.88	$.75
Chicago Heights	.88	.75
Momence	.88	.75
St. Anne	.84	.75
Watseka	.84	.75

To	From Summit Grove Group. Present	Proposed
Chicago	$.88	$.80
Chicago Heights	.88	.80
Momence	.88	.80
St. Anne	.84	.80
Watseka	.84	.80

Southern Freight Association Docket

24901. Rock asphalt. Carloads, as described in I. C. R. R. Tariff 2316H, I. C. C. 6928, from Big Clifty, Rockport and Summit, Ky., to Decatur, Ala. Present rate, $3.20 per net ton; proposed, $2.90 per net ton.

24918. Marble and stone, crushed. Carloads, minimum weight 80% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight will govern, from Tate, Ga., to Atlanta, Ga. (when for beyond) (interstate). Present rate, 25 cents per 100 lb. (Class A); proposed, 95 cents per net ton, based on the Georgia-Alabama scale for the distance.

24958. Sand, molding. Carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight will govern, from Round Mountain, Ala., to Charlotte, N. C. Present rate, $6.60 per net ton (Class A); proposed, $2.25 per net ton, same as rate in effect from Cook Springs and Ragland, Ala.

24964. Sand. It is proposed to restrict the through Class "E" rate from Klondike, Mo., to Memphis, Tenn., so as not to apply on sand, carloads. This in order that shippers at Klondike may avail themselves of St. Louis, Mo., combination, applying beyond St. Louis to Memphis rate of 15 cents per 100 lb., it is proposed to publish.

25008. Sand and gravel in straight or mixed, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight will govern, from Chattanooga, Tenn., to Blue Ridge and Ellijay, Ga. Present rates: To Ellijay, $3.60; Blue Ridge, $3.90 per net ton. Proposed, $1.78 per net ton, made on same basis as used in connection with rate recently established to Centon, Ga.

25013. Rock asphalt. Carloads, as described in I. C. R. R. Tariff I. C. C. 6928, from Big Clifty, Rockport and Summit, Ky., to Albany, Ala. Present rate, $3.20 per net ton (cement rate); proposed, $3.04 per net ton, based on 90 cents to Central City and $2.14 per ton beyond.

25027. Sand and gravel. Carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight will govern, from Saffold, Ga., to Panama City, Fla. Present rate, $2.40; proposed, $1.58 per net ton, based on the carrier's proposed Georgia scale for the joint line distance over trunk and short lines less 10%.

25032. Stone, marble or slate, broken or crushed. Carloads, minimum weight 90% of marked capacity of car, except when car is loaded to full visible capacity, actual weight will govern, from Tollico Plains and Marmor, Tenn., to New Orleans, La. Present rate, $3.15 per net ton; proposed, $3.03 per net ton, made with relation to existing rate from Whitestone, Ga.

25039. Phosphate rock. Carloads, minimum weight 40,000 lb., except when marked capacity is less, in which case the marked capacity of the car will be the minimum weight, from Cumberland Furnace, Tenn., to Louisville, Ky., Nashville, Tenn., Anniston, Ala., Rockdale, Tenn., and Chicago, Ill. Class "N" rates now apply, except to Chicago, Ill., combination applies. Proposed: To Louisville, Ky., $3.15; Nashville, Tenn., $1.75; Anniston, Ala., $3.69; Rockdale, Tenn., $2.48, and Chicago, Ill., $5.04 per net ton, the proposed rates being made with relation to rates from Mt. Pleasant, Tenn.

25058. Sand and gravel, straight or mixed. Carloads, minimum weight 90% of marked capacity of car, except that when cars are loaded to their visible capacity, actual weight shall govern, from Carrollton, Ky., to Lexington, Midway, Jett, Frankfort, Bagdad, Christiansburg, Cropper and Pleasureville, Ky. Present rate to Lexington, $1.35; proposed, $1.14 per net ton, based 10 cents higher than rate from Louisville, Ky. It is also proposed to reduce the rate to the other points named to $1.14 per net ton or the same as proposed to Lexington, Ky.

25095. Stone. It is proposed to establish the following rates on stone, rough quarried, planed or sawed, carloads, minimum weight 30,000 lb., from Bowling Green, Ky., to apply in lieu of combination rates: To Jacksonville, Ga., 24 cents; Athens, Ga., Augusta, Ga., Macon, Ga., 21½ cents per 100 lb. The rates proposed are arrived at on basis of Nashville, Tenn., combination, subject to Agent Jones' Tariff 228, where involved, and observing the Louisville, Ky., rates as maxima.

Western Trunk Line Docket

4701. Gypsum. Carloads, from Centerville, Iowa, to C. M. & St. P. stations, Hudson to McCook, S. D., inclusive. Present, 19 cents per 100 lb., minimum weight 40,000 lb.; proposed, 17 cents per 100 lb., minimum weight 60,000 lb. (in addition to present rate as shown above).

5110. Stone, crushed or ground. Carloads, from McDowell, Mo., to points in Kansas on M. K. T. Rate: Present Class E. Proposed, through rates based on the Kansas joint line scale plus switching at Kansas City of $6.30. Minimum weight 90% of marked capacity of car, except when weight of shipment loaded to full visible capacity of car is less than 90% of marked capacity of car, the actual weight will apply; in no case shall the minimum weight be less than 40,000 lb.

Trunk Line Association Docket

12978. To increase rate of $1.40 to $1.60 per net ton on crushed stone, carloads, from LeRoy and Stafford, N. Y., to Bennetts, Greenwood, Rexville, Barney Mills, McGraws, Edwards, Whiteville, Culver and Paynesville, N. Y.

Southwestern Freight Bureau Docket

7013. Limestone from points in Oklahoma to Ada, Okla. To establish a rate of 10 cents per net ton on limestone, crushed, gypsum rock, crushed or shale, straight or mixed carloads, minimum weight 110% of marked capacity of car, from Lantry to Lawrence, Okla., to Ada, Okla. It is desired to reinstate the rate that was in effect prior to General Order 28, namely 10 cents per net ton.

7022. Stone, from points on the M. & N. A. R.R. to points on the St. L. S. F. Ry. To establish a rate of 10 cents per 100 lb.,to St. L.-S. F. Ry stations, Osborne to Fayetteville, Ark., inclusive and a rate of 11 cents per 100 lb., to St. L.-S. F. Ry. stations south of Fayetteville, Ark., to and including carloads, minimum weight 40,000 lb. from M. & N. A. R. R. stations, Eureka Springs, Ark., and north. It is stated that the present rates are entirely too high to permit movement and that there is prospect of quite a movement provided reasonable rates can be secured.

7027. Granite from Mountain Park, Okla., to St. Cloud, Minn. To establish a rate of 38 cents per 100 lb. on rough granite. Carloads, minimum weight marked capacity of car but not less than 40,000 lb. from Mountain Park, Okla., to St. Cloud, Minn. It is desired to publish a through rate of 38 cents per 100 lb. to apply via St. L.-S. F. Ry., of Kansas City, Mo., C. B. & Q. R. R. and Minnesota Transfer, Great Northern and Northern Pacific R. R., also via Sioux City, Ia., and the Great Northern R. R.

7061. Sand from Guion, Ark., to Three Rivers, Tex. To establish a rate of 23 cents per 100 lb. on sand. Carloads, minimum weight 80,000 lb., or if marked capacity of car is less than 80,000 lb., marked capacity will govern from Guilion, Ark., to Three Rivers, Tex. Shipper requests the publication of the Laredo, Tex., rate to Three Rivers, Tex.

7064. Stone. From Carthage, Mo., to points in Oklahoma. To establish a rate of 14½ cents per 100 lb., on stone (including granite, jasper, marble or onyx) rough, quarried or sawed nor further finished. Carloads, minimum weight, 50,000 lb., from Carthage, Mo., to stations on the Ft. Smith & Western R. R., Bokoshe to Midlothian, Okla., inclusive. The rates proposed herein are the same as now in effect via the St. L.-S. F. Ry. in their Tariff 3165C with the exception of Dustin, Okla. It is desired that competing lines be placed on a parity with the Frisco R. R.

7106. Gravel from points in Arkansas and Louisiana to points in Texas. To establish the single line rates carried in Column 1 of S. W. L. Tariff 114 A for distances 250 miles and less. Rates to be based upon actual distances traversed on gravel. Carloads, minimum weight 80,000 lb., or marked capacity of car if less than 80,000 lb., from Arkansas and Louisiana producing points on the St. L. S. W. Ry. It is desired of the St. L. S. W. Ry. to meet the competition ofthe Mo. Pac. R. R., K. C. S. Ry., T. & P. Ry., L. R. & N., etc.

7107. Gravel, from points in Arkansas to points in Texas. To establish the 9702 joint line scale on gravel. Carloads, minimum weight 80,000 lb., from stations in Arkansas on the K. C. S. Ry., or marked capacity of car if less than 80,000 lb., to stations on the St. L. S. W. Ry. in Texas up to 250 miles. It is stated that on account of construction work in Texas at points reached by St. Louis W. Ry. of Texas much gravel will be used and St. L. S. W. Ry. stations should be on same basis as points on other lines.

New England Freight Association Docket

9533. Granite, rough quarried or chiseled, hammered or sawed (not sand rubbed, carved, lettered, polished or traced) and granite paving or granite curbing, minimum weight 50,000 lb., from South Milford, N. H., and West Chelmsford, Mass., to South Utica, N. Y., $2.21½. Reason: To place the rate to South Utica, N. Y., on a parity with the rate now in effect to Utica, N. Y.

9537. Granite, rough quarried, or chiseled, hammered or sawed (not sand rubbed, carved, lettered, polished or traced) and granite paving or granite curbing, minimum weight 50,000 lb., from Webb, N. H., to Philadelphia, Pa., 24. Reason: To place the rate from Webb, N. H., on a parity with the rate from other granite shipping points on the B. & M. R. R.

9570. Sand, building, common or run of bank, minimum weight 90% of the marked capacity of the car, from Union City, Conn., to Bridgeport, Conn., 3½ cents. Reason: Equalization of rate conditions.

American Concrete Institute Arranges Attractive Convention Program

THE twenty-second annual convention of the American Concrete Institute will be held at the Hotel Sherman, Chicago, on February 23 to 26. The convention committee has drawn up an excellent program which includes papers by authorities on subjects of great importance to all the concrete industry. Some of the outstanding things to be brought out at the meetings are as follows:

Frank H. Alfred, president and general manager of the Pere Marquette Railway, who has recently gone on record favoring a better type of track support, one of reinforced concrete for economy and speed on heavy traffic lines, will present a paper on this subject at the opening session of the convention, Tuesday afternoon, February 23.

This will be followed by a discussion, in which a number of railway engineers are invited to participate, on "Railroads and Concrete," in answer to the question, "Just how far have the railroads gone in a progressive attitude toward modern design and construction with concrete?"

The session Tuesday evening, February 23, will feature a "Question Box."

The session Wednesday evening, February 24, should be of very general interest in an architectural way. John J. Earley will discuss this with two themes under a general heading of "Architectural Concrete." The background for this discussion will be his work on the Tennessee Parthenon and the Louisiana State University Group at Baton Rouge.

David C. Allison of Allison & Allison, architects, Los Angeles, will present a paper discussing, first, briefly, the structural principles in our present day steel and concrete buildings as differing from the structural principles upon which traditional architecture is based.

This will be followed by an address by A. O. Malone, a master craftsman in stucco, who will demonstrate on the floor of the convention the actual application of stucco in new textures.

The Wednesday morning and afternoon sessions will be devoted to discussion of the field application of quality control methods for concrete.

Thursday morning will be devoted to technical aspects of concrete building units.

Thursday afternoon will be devoted to an inspection of work actually in progress in quality control of concrete on the Wacker drive.

Thursday evening will be devoted chiefly to concrete floors and concrete roads.

Friday morning will receive papers and reports bearing chiefly on interesting test investigations of concrete as already outlined.

Among important papers to be presented are those by A. T. Goldbeck, engineer of the National Crushed Stone Association, and those of the committee E-5. The latter will present a proposed form of purchase specifications for aggregate.

National Concrete Products Association Annual Meeting

THE National Concrete Products Association makes the following announcement of the annual meeting:

"After careful consideration, the convention committee of the Concrete Products Association has made definite arrangements to hold the annual meeting of the national organization at Hotel Sherman, Chicago, February 25-26, 1926.

The committee's decision to reverse its previous action in selecting Cleveland as the convention city has the approval of the president and is concurred in by the executive committee. In its earlier deliberations the convention took into account the desire of many of the Ohio members that the meeting be held in their city and the advantages of Cleveland as the center for an unusually large number of concrete products factories.

"Since the announcements appeared designating Cleveland, it became possible to arrange a program interlocking with that of the American Concrete Institute during the week of February 23-26, at Chicago, which will co-ordinate the subject matter of the two meetings to best advantage for the concrete products manufacturers and at the same time assure our members of reduced rates to the meeting with considerable saving in time and hotel expense.

"Your committee also feels that in moving the national meeting from Cleveland to Chicago, it is materially assisting the Ohio association in getting good attendance at its annual meeting at Toledo, whereas a meeting at Cleveland might have divided local interest.

JOHN POWERS,
Chairman, Convention Committee.

Dixie Concrete Products Association Entertains Dealers and Engineers

OVER 100 dealers, contractors and engineers were guests at a recent banquet given by the Dixie Concrete Products Association at the Hotel Patten, Chattanooga, Tenn. The president of the Association, E. W. Arnold, acted as toastmaster and presented many interesting speakers, among whom was A. J. R. Curtis, manager of the Cement Products section of the Portland Cement Association.

Mr. Curtis' subject was "Concrete Masonry and Stucco" and he brought out the considerable growth of this industry as compared with other building materials and predicted the entrance of a great era of stucco finishes. Some very interesting demonstrations on cement products were also shown.

Ohio Concrete Products Men Meet at Toledo

THE Ohio Concrete Products Association held its fifth annual convention recently at the Waldorf Hotel, Toledo, Ohio. From the papers presented and the attendance, it was by far the most successful convention in the association's history.

The convention was opened by an address from the Hon. Fred J. Mery, mayor of Toledo. The president of the association, S. I. Crew, followed with a short outline of the accomplishments of the past five years and the objectives of the future. In turn, the members heard some very interesting papers on different subjects by prominent men.

Among these speakers was E. W. Dienhart, who presented the need of good cost systems for the efficient operation of cement products plants. This brought considerable discussion from the body and a resolution was passed and a committee appointed to investigate cost operation in a number of different plants throughout the state. Mr. Deinhart, who is general manager of the Acme Concrete Products and Gravel Co., Cement City, Mich., and formerly connected with the Portland Cement Association, is quite well known to ROCK PRODUCTS readers, many of whom have read with interest his address before the cement products division of the National Sand and Gravel Association at its 1925 convention. (See ROCK PRODUCTS, May 30 issue, p. 66.) F. Leo Smith, assistant secretary, Board of Building Standards, Ohio, spoke on the recent revisions of the state's building code. The revised code, he said, admitted the use of concrete building units on an equal basis with brick, tile, etc. The use of these units is sure to increase when further changes in the code that the association is asking are granted.

The close of the business meeting was followed by the annual banquet in the evening of the second day of the convention. On the last day an inspection visit was made to the sand plant of the Sandusky Cement Co. and to the automobile plant of the Willys-Overland Co.

The following officers were elected to serve in 1926: S. I. Crew, Concrete Products Co., Norwood, Ohio, president; Frank Owen, Owen Concrete Products Co., Akron, Ohio, vice-president, and George M. Friel, Anchor Concrete Machinery Co., Columbus, Ohio, secretary-treasurer.

Plan Consolidation of Cement Products Plants

PLANS for the formation of the National Concrete Products Corp. as a $10,000,000 consolidation of plants throughout the United States and Canada, which now operate under patents controlled by the Building Units Patents Corp., were announced recently in New York.—*Chicago (Ill.) Tribune.*

Neal Gravel Company Purchases Covington Company's Holdings

THE Neal Gravel Co., Mattoon, Ill., made a large addition to their already extensive sand and gravel properties in Indiana by their recent purchase of the plant and holdings of the Covington Sand and Gravel Co. at Covington, Ind. The deposit included in the sale is known as the Stevens pit, has been worked since 1907 and has been the source of a great deal of the sand and gravel used in the district. The Covington property has been greatly improved within the past few years, a switch having been

H. E. Neal, president, Neal Gravel Co.

built from the main line of the Big Four railroad and new plant equipment put in place. The output is estimated at about 150,000 cu. yd. per year.

The Neal Gravel Co. owners and operates plants at Attica, Cayuga, Summit Grove, Wolcottville and Covington, Ind., and at Palestine, Ill., in addition to this new purchase. The Attica and Wolcottville plants were purchased about a year ago from the Carmichael Gravel Co., Danville, Ill. The combined output of the Indiana plants is said to be about 1,500,000 tons of sand and gravel per year, making the Neal company one of the largest producers in the United States. The officers of the Neal Gravel Co. are: H. E. Neal, president; B. E. Neal, vice-president, and E. Guy Sutton, secretary-treasurer; J. P. Cantlon is sales manager, and F. P. Steinberg, works manager.—*Danvillle (Ill.) News.*

Tennessee Gravel Plant Remodelled

THE Wolf River Sand and Gravel Co., Memphis, Tenn., has recently completed the extensive changes at its plant in Memphis. The large demand the past year made considerable enlargement necessary of plant and operating equipment.

One of the features of the improvements was the change from steam to electric power to operate the plant and dredge. By the addition of several new pumps, the washing capacity was tripled. A conveyor belt line to feed the hopper leading to the screening plant is under construction.

With the entire power of the company changed to electricity, with a largely increased screening surface, with additional loading bins and a new electric crane, purchased recently, the capacity of this plant is said to have been increased to 1000 cu. yd. of washed and screened sand and gravel a day, which in an emergency could be increased to 2000 yd. Everything will be practically new at this plant, and as the capital of the company was doubled last year, its officers anticipate a very prosperous season. At the annual meeting all officers were re-elected and complimented by the stockholders on the excellent showing made during last year in the face of adverse working conditions. — *Memphis (Tenn.) Commercial Appeal.*

Lutesville Sand and Gravel Company to Erect Plant at Jonesburg

ESTABLISHMENT by the Lutesville Sand and Gravel Co., Cape Girardeau, Mo., of a new plant at Jonesburg, Mo., to supply materials for state highway work, was announced at the offices of the company. This will be in addition to the plants maintained in Southeast Missouri.

Equipment for this plant is a part of holdings of the Madison County Sand and Gravel Co. of Fredericktown, which recently merged with the Cape Girardeau concern. Formerly the company had two plants, one at Fredericktown and the other at Patton, and equipment from one was moved to Jonesburg. (See ROCK PRODUCTS, January 23, issue for merger details.) The new officers of the Lutesville Sand and Gravel Co. are A. H. Harrison, president; H. H. Humphreys, vice-president; C. L. Harrison, treasurer, and Robert Harrison, secretary. Herman Loeffel is manager of the Lutesville plant, and S. I. Kiger will direct operations of the Jonesburg plant.—*Cape Girardeau (Mo.) Missourian.*

Gravel Plant To Be Electrified

THE West Monroe, La., plant of the Victor Sand and Gravel Co., Shreveport, La., is to be electrified. The company has contracted with the Louisiana Power and Light Co. for 800 h.p. of electrical energy to operate motors used for pumping, washing and loading sand and gravel. The company has been using steam power, with natural gas as fuel. Besides economy of operation, the substitution of electric power for steam will enable the company to place its suction dredge machinery on a barge and move it about easily, improving efficiency of operations. The Victor Sand and Gravel Co. will move about 6000 yd. of gravel, equivalent to 60 cars daily.—*Monroe (La.) News Star.*

New Gravel Company to Operate in Monroe, Louisiana, District

EXTENSIVE plans are being executed by the Union Gravel Co. of Monroe, La., for the development of their holdings located about three miles west of West Monroe, La. This company, the chief stockholders of which are George W. Wise, of Monroe, George K. Force of Baton Rouge, and J. F. Head, of West Monroe, are rapidly putting their plant in workable shape, the company having been recently incorporated with a capitalization of $50,000.

At this time, right of way has been surveyed to the V. S. & P. railroad in order to secure the required sidetracks for loading the output of the gravel pit. Machinery required is being installed and an artesian well is being drilled. This well is now at 450 ft. It is to go to a depth of about 650 ft. and the water is to be used for the washing of the sand and gravel.

The Monroe district already has a number of sand and gravel plants which supply the different parts of the state with their product. The new company is expected to begin production within a short time.—*Monroe (La.) Star.*

R. D. Herbert to Head Southern Dealers' Association

MEMPHIS, Tenn., gave a royal welcome to the members of the Southern Builders Supply Association, who held their convention at that city recently at the Peabody Hotel. There were many interesting features on the program, of both the business meetings and at the entertainments. Walter F. Jahncke, retiring president of the association, was presented with a beautiful 18-in. loving cup, suitably inscribed, by the members of the association for his untiring efforts and achievements in furthering the association work. Mr. Jahncke is superintendent of Jahncke Service, Inc., of New Orleans, La., operating sand and gravel plants at Roseland, La., and Condron, Miss., in addition to their extensive building supply business.

Robert D. Herbert of Nashville, Tenn., was elected president of the association for the coming year. Mr. Herbert is a member of the firm of T. L. Herbert & Sons of Nashville, Tenn., who operate several sand and gravel plants, and is also secretary-treasurer of the Hermitage Portland Cement Co. of Nashville. H. Ball Bowers of the Carolina Portland Cement Co. was elected treasurer. The new board of directors contains many men prominent in the rock products industries of the South, such as Walter F. Jahncke, R. D. Herbert, and W. W. Fischer, Fischer Lime and Cement Co.

After the conclusion of the convention sessions the visitors were taken for an automobile trip about Memphis and an inspection of the large new sand and gravel yard of the Fischer Lime and Cement Co.

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

Cement Blocks Can Be Sold in Winter

Why and How Concrete Masonry Is Being Laid at Profit in Cold Weather in Wisconsin

By "Spec" Collins

Secretary, Wisconsin Concrete Products Association, Milwaukee, Wis.

NOT EVERYONE agrees that it is a profitable proposition to lay concrete masonry in cold weather. Yet if you will talk to broad-minded contractors who have formed this habit, you will find that it is paying them more profit than the dollars and cents involved in any particular cold weather job. In fact, the custom—once it has become a custom—has a number of hidden profits. In order to handle any great amount of work the mason contractor must necessarily buy quite a bit of equipment. Interest on this investment must be figured on a yearly basis—and winter jobs lessen that item on each individual job, whether it be laid in spring, summer, fall or winter.

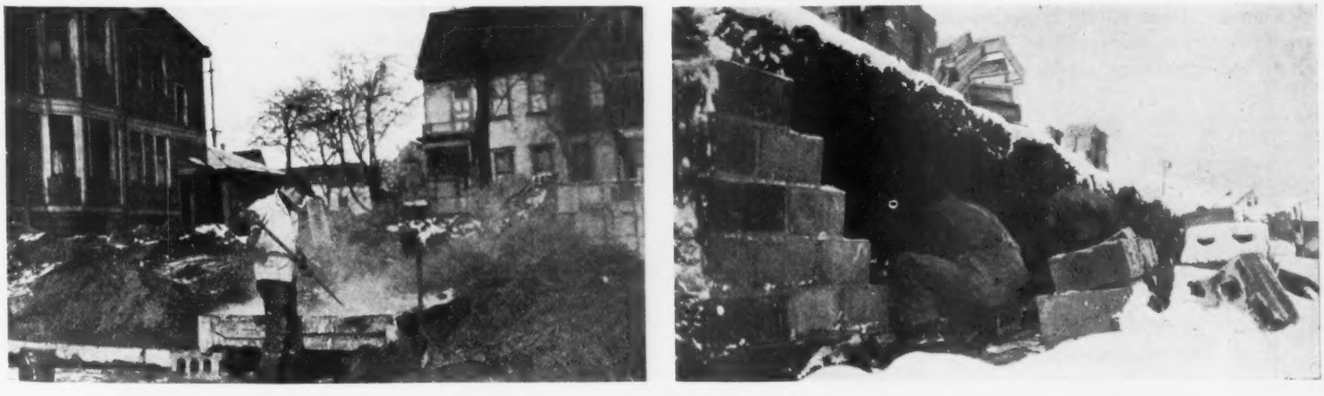
Then again the successful mason contractor must spend much time and money on building his organization if he is to handle any great number of jobs. How much of this expense he must go through each spring depends to a great extent, on how much winter work he carries on. Naturally, this "organization building" must be charged to overhead—and overhead must be charged against every individual job. The more jobs, the less the task of rebuilding organizations and the less overhead to deduct from the profit of the individual job.

For several winters past, I have been watching winter construction with concrete masonry. The thing that has surprised me is not the great number of precautions that have been necessary, but the few. Masons seem quick to adapt themselves to this sort of work and carry it on with a snap and vigor not seen when the mercury threatens to pop out of the top of the tube.

While the advantages of laying concrete block are greater than those of laying concrete brick in the winter months, it is surprising how many of the latter jobs are being carried on in the territory which I cover. The contractors tell me, too, that there seems to be little variation in the number of these smaller units laid in the winter from summer. Yet the big advantage comes in laying concrete block. Walls go up quickly with them. Large units require comparatively few joints and require less mortar—material for which must be heated. The size of the unit has another great advantage, for if heated slightly they hold the warmth for a long period and protect the small volume of mortar in which they are laid from freezing. Every cement products manufacturer should have these points well in mind and see to it that his mason customers are familiar with them.

Hints to Give the Contractor

Where footings or other monolithic concrete work is required in connection with a concrete masonry job, the ordinary precautions must be taken. The ground should be free from frost. Forms should be cleaned so that they are free of ice and snow. Water and aggregate should be heated. As soon as the job is placed, it should be covered with tar paper or canvas and a foot or so of tightly packed hay or straw. This protection should be continued until there is a certainty that the concrete has set properly. Many contractors think that testing by striking with a hammer will determine whether concrete placed in cold weather has set properly. This method is often misleading. The only safe test is the application of heat. Frozen concrete will soften when heat is applied. Properly set concrete will not.



Visible evidence that cement block can be sold and laid even in the severe winter weather of Wisconsin

When concrete masonry is laid in cold weather, it is often necessary to protect the wall overnight to be certain that the mortar does not freeze. This is a small matter, however, and can be cared for in the same manner in which monolithic concrete is protected—by canvas or tar paper, with an intervening layer of hay or straw. This really is necessary only in extremely cold weather and comparatively few masons employ it.

One practice which is becoming more common is that of heating the block before they are laid. This not only gets any frost that may be in them out, but is said to accelerate the hardening of the mortar. Some contractors have the block piled when unloaded in a hollow square. This is covered with a canvas and heat supplied by a common salamander. One contractor has a knockdown canvas frame which he uses very successfully for this purpose. The contractor should heat the units to about 70 deg. F., making certain that no bits of ice or snow are present at any spot on the mortar bed. The salamander seems to be the accepted heating device, though I have seen sheet iron stoves, conical in shape and similar to those so familiar with the forces in France during the world war, used to advantage.

Cement block construction despite the snow and cold

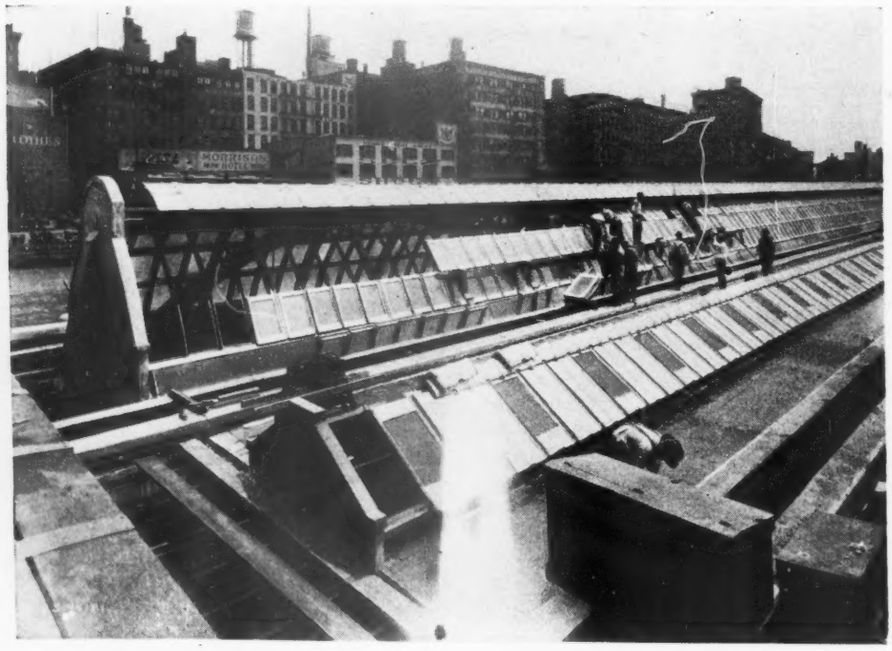
A precaution taken by every contractor is that of heating his mortar. In moderately cold weather, this can be done by heating only the water, but in severe cold weather, both the water and aggregate must be heated. Under no circumstances should sand which contains frost or frozen lumps be used for mortar. No harm may be expected where even boiling water is used for mortar or concrete. Sand, in cold weather, should be heated to a temperature of 100 deg. F. The temperature of the mortar after mixing should be at least 70 deg. F. if the weather is below freezing.

Water and sand can both be heated by discharging steam into them if it is available. However, most contractors usually use some sort of a metal container for heating water, supporting it on a rough stove constructed of concrete block. Probably the most universal method of heating sand is by piling it over an old section of metal culvert or smokestack, in which a fire is kindled. If it is possible to provide some sort of chimney for the improvised fire box, it is best to do so.

In the past most masons discontinued work when the temperature reached 15 deg. above zero. However, as they have become more and more accustomed to winter work, they are gradually working in lower and lower temperatures. They are finding that winter construction with concrete masonry is a paying proposition from many angles.

Cement Roofing Tile With Glass Lights

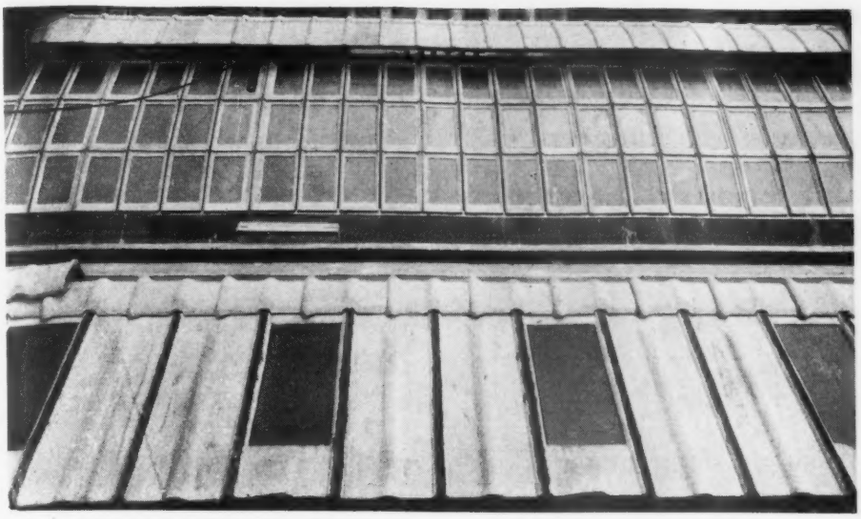
ONE of the many features of the new Chicago Union station is the construction of the train sheds. These were built with an eye to pleasing appearance and for protection from the driving rain and snow storms which occur often in Chicago. The particular feature of this construction for cement products manufacturer lies in the type of roof covering on these sheds. This was of cement tile and premoulded cement tile with glass inserts and was furnished by the Federal Cement Tile Co., Chicago, Ill.



Laying cement roofing tile over the new Chicago Union station trainsheds

The profile of the roof cross section was such that it called for the exercise of ingenuity and good workmanship to provide a precast tile that would insure a perfect fit to the curves and angles of the steel frame. It was necessary to provide 11 varieties of the units for the standard portions of the shed and special units used in the portion of the sheds near the outer ends where it conforms to the curves of converging tracks.

Premoulded concrete tile with glass inserts were chosen for roof covering as being economical, substantial in appearance and in keeping with the rest of work. The gutters are waterproofed with a built-in asphalt roofing. Three sections of glass tiles of a combined length of about 9 ft. on each side of the monitors provide a continuous skylight over the passenger platforms. Skylights over the baggage platform are provided by making every third roof tile of 24 in. width and 52 in. length a glass tile. The glass tile are of particular interest because the ¼ in. wire glass is imbedded into the slabs in manufacture and is protected against stresses set up by changes in temperature, wind pressure and other stresses by dipping the edges of the glass in a hot asphalt



Section over the sheds of the Chicago union station showing the special cement tile with glass inserts

preparation before inserting in the concrete. This leaves nothing but the concrete surface of the tile and the glass exposed to weather. The tile itself is reinforced with wire mesh. While the tile were specially designed for the job, they are similar in character to the standard tile made by the company, which is 21x35 in. with wire glass insert, cast into concrete and are provided with a weep-hole to permit condensation to drain off of the underside of the glass and through the weep-hole onto the exterior of the roof. The roof tile, both glass and slab, are furnished in a non-fugitive red color and add a good deal to the attractiveness of the finished structure.

Interior view of a section of the roof over one of the trainsheds

Market Prices of Cement Products

Concrete Block

Prices given are net per unit, f.o.b. plant or nearest shipping point

City of shipping point	Sizes 8x8x16	8x10x16	8x12x16
Camden and Trenton, N. J	.....	.19‡	.30‡
Columbus, Ohio	.16@.18a	.....	.....
Detroit, Mich.	16.00*	.....	26.00*
Forest Park, Ill.	18.00*	23.00*	30.00*
Graettinger, Iowa	.18@.20	.....	.....
Indianapolis, Ind.	.13@.15†	.....	.....
Los Angeles, Calif.	4x3½x12—.03;	6x3½x12—.04½;	8x3½x12—.05½
Oak Park, Ill.	.18@.21a	.....	.....
Somerset, Pa.	.20@.22	.....	.....
Yakima, Wash.	20.00*	.....	.....

*Price per 100 at plant. †Rock or panel face. (a) Face. ‡ Delivered.

Concrete Brick

Prices given per 1000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Appleton, Minn.	22.00	25.00@35.00
Baltimore, Md. (Del. according to quantity)	15.50	22.00@50.00
Camden and Trenton, N. J.	17.00	
Ensley, Ala. ("Slagtex")	14.50	22.50@33.50
Eugene, Ore.	25.00	35.00@75.00
Friesland, Wis.	22.00	32.00
Longview, Wash.	18.00	25.00@50.00
Milwaukee, Wis.	15.00	33.00
Mt. Pleasant, N. Y.		14.00@23.00
Omaha, Neb.	18.00	30.00@40.00
Pasadena, Calif.	12.50	
Philadelphia, Penn.	†15.25	‡21.50
Portland, Ore.	17.00	25.00@75.00
Prairie du Chien, Wis.	14.00	22.50
Rapid City, S. D.	18.00	25.00@40.00
Waco, Texas	16.50	32.50@125.00
Watertown, N. Y.	21.00	35.00
Wauwatosa, Wis.	14.00	20.00@42.00
Winnipeg, Man.	14.00	22.00
Yakima, Wash.	22.50	.....

†Gray. ‡Red.

Cement Tile

Prices are net per sq. in carload lots, f.o.b. nearest shipping point unless otherwise stated.

Camden and Trenton, N. J.—8x12, per sq.	
Red	15.00
Green	18.00
Cement City, Mich. — 5"x8"x12", per M	55.00
Chicago, Ill.—per sq.	20.00
Detroit, Mich.—per 100	70.00
Grand Rapids, Mich.:	Per 1000
5x4x12	45.00
5x8x12	70.00
5x8x 6	35.00
Graettinger, Iowa.—Cement tile per 100 ft.	
5-in.	4.50
6-in.	5.50
8-in.	8.50
10-in.	12.50
12-in.	17.50
14-in.	22.50
16-in.	30.00
18-in.	35.00
20-in.	40.00
22-in.	45.00
24-in.	50.00
Houston, Texas.—Roofing Tile, per sq.	
Red	17.00
Green	19.50

	Per 1000
5x4x12 (Lightweight)	45.00
5x8x12 (Lightweight)	80.00
Indianapolis, Ind.—9"x15"	
Gray	10.00
Red	11.00
Green	13.00
Longview, Wash.—(Stone Tile)	Per 1000
4x6x12	60.00
4x8x12	65.00
Mt. Pleasant, N. Y.:	Per 1000
5x8x12	78.00
Pasadena, Calif.:	Per 1000
4x4x12	$30.00
4x6x12	50.00
4x8x12	60.00
Tacoma, Wash.—Drain tile per ft.:	
3 in.	.04
4 in.	.05
6 in.	.07½
8 in.	.10
Waco, Texas:	Per sq.
4x4	.60
Wildasin Spur, Los Angeles, Calif:	
4x3½x12	.03½
6x3½12	.04½
8x3½x12	.05½
Yakima, Wash.:	
5x8x12	.10

Current Prices Cement Pipe

Prices are net per foot f.o.b. cities or nearest shipping point in carload lots unless otherwise noted.

Culvert and Sewer	4 in.	6 in.	8 in.	10 in.	12 in.	15 in.	18 in.	20 in.	22 in.	24 in.	27 in.	30 in.	36 in.	42 in.	48 in.	54 in.	60 in.
Detroit, Mich.								$14.00 per ton									
Graettinger, Iowa	.04½d	.05½	.08½	.13	.17½	.....	.50	.60	.75	.85	.....	.....	.....	.....	.....	.....	.....
G'd Rapids, Mich. (b)	.....	.....	.....	.60	.72	1.00	1.28	.....	.....	1.92	2.32	3.00	4.00	.....	.....	.....	.....
Houston, Texas	.....	.19	.24	.43	.55½	.90	1.30	.....	†1.70	2.20	.....	.....	.....	.....	.....	.....	.....
Indianapolis, Ind. (a)	.....	.....	.....	.80	.90	1.10	1.30	.....	.....	1.70	.....	2.70	.....	.....	.....	.....	.....
Longview, Wash.							Sewer pipe 40% off list, culvert—list										
Mankato, Minn. (b)	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.50	1.75	2.50	3.25	4.25	.....	.....	.....
Mt. Pleasant, N. Y.	.....	.17	.26	.39	.50	.68	.93	1.29	.....	1.67	.....	.....	.....	.....	.....	.....	.....
Norfolk, Neb. (b)	.....	.....	.....	.90	1.00	1.13	1.42	.....	.....	2.11	.....	2.75	3.58	.....	6.14	.....	7.78
Paullina, Iowa‡	.....	.....	.....	.....	.....	.....	.....	2.25	.....	2.11	.....	2.75	3.58	.....	6.14	.....	7.78
Somerset, Pa.	.....	.....	.....	.....	80[1]	1.00[2]	1.40[3]	.....	.....	2.00[4]	.....	3.25[5]	4.00[6]	6.00[7]	.....	.....	.....
Tacoma, Wash.	.15	.18	.22½	.30	.40	.55	.80	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Tiskila, Ill. (rein.) (a)	.....	.....	.....	.65	.75	.85	1.10	1.60	.....	1.90	.....	.....	3.40	.....	.....	.....	.....
Wahoo, Neb. (b)	.....	.....	.....	.....	1.00	1.13	1.42	.....	.....	2.11	.....	2.75	3.58	4.62	6.14	6.96	7.78
Waukesha, Wis.								All sizes $9.00 per ton									
Yakima, Wash.								$10.00 per ton									

*30-in. lengths up to 27-in. diam., 48-in. lengths after: (a) 24-in. lengths; (b) Reinforced; (c) Interlocking bar reinforced.
†21-in. diam. ‡Price per 2 ft. length. (d) 5 in. diam. [1]@1.08. [2]@1.25. [3]@1.65. [4]@2.50. [5]@3.85. [6]@5.00. [7]@7.50.

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F.O.B., at producing point or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Buffalo, N. Y.	1.30	1.30	1.30	1.30	1.30	1.30
Carey, Ohio	.65@ .75	.90@1.10	.85@1.00	.80@ .90	.80@ .90	.80@ .90
Chaumont, N. Y.	.50	.....	1.75	1.25	1.25	1.25
Chazy, N. Y.	.75	1.65	1.65	1.40	1.40	1.40
Cobleskill, N. Y.	1.50	1.35	1.25	1.25	.....	.....
Eastern Pennsylvania	1.35	1.35	1.35	1.35	1.35	1.35
Frederick, Md.	.50	.75	1.30	1.20	1.10	1.10
Munns, N. Y.	1.00	1.40	1.40	1.40	1.25	.....
Northern New Jersey	1.60	1.50@1.80	1.30@2.00	1.40@1.60	1.40@1.60	.....
Prospect, N. Y.	1.00	1.40	1.40	1.30	1.30	.....
Walford, Penn.	1.00	1.30	.....	1.50h	1.50h	.....
Watertown, N. Y.	.50	.....	1.75	1.50	1.50	1.50
Western New York	.85	1.25	1.25	1.25	1.25	1.25
CENTRAL						
Afton, Mich.	.....	.....	.....	.....	.50	.50@1.00
Alton, Ill.	1.85	.....	1.85	.....	.....	.....
Bloomville, Middlepoint, Dunkirk Bellevue, Waterville, No. Baltimore, Holland, Kenton, New Paris, Ohio; Monroe, Mich.; Huntington, Bluffton, Ind.	1.00	1.10	1.10	1.00	1.00	1.00
Buffalo, Iowa	1.10	.....	1.30	1.10	1.15	1.15
Chasco, Ill.	.....	1.15	1.15	1.15	1.15	.....
Columbia, Krause, Valmeyer, Ill.	1.00@1.50	1.20@1.25	1.20@1.25	1.20	1.20	1.50
			Flux all at 1.30			
Cypress, Ill.	1.15	1.15	1.15	1.15	1.05	1.00
Gary, Ill.	1.00	1.37½	1.37½	1.37½	1.37½	1.37½
Greencastle, Ind.	1.25	1.25	1.15	1.05	.95	.95
Lannon, Wis.	.80	1.10	1.10	.95	.95	.95
Milltown, Ind.	.....	.75@ .90	.75@ .90	.85@ .90	.85@ .90	.85@ .90
Northern New Jersey	1.30	.....	1.80	1.60	1.40	.....
River Rouge, Mich.	1.10	1.10	1.10	1.10	1.10	1.10
St. Vincent de Paul, Que.	.75	1.25	1.05	.95	.90	.90
Sheboygan, Wis.	1.10	1.10	1.10	1.10	1.10	.....
Stone City, Iowa	.75	.....	1.10†	1.05	1.00	.....
Waukesha, Wis.	.90	.90	.90	.90	.90	.90
SOUTHERN:						
Allgood, Ala.			Crusher run, fines out, for flux, 1.00 per net ton			
Cartersville, Ga.	.....	1.50@1.65	1.25@1.50	1.15	1.10	.....
Chico, Texas	1.00	1.40	1.35	1.25	1.20	1.15
El Paso, Tex.	.75	1.00	1.00	1.00	1.00	.....
Ft. Springs, W. Va.	.50	1.60	1.50	1.35	1.25	.....
Graystone, Ala.			Crusher run fluxing stone, 1.00 per net ton			
Henderson, N. C.	.....	.....	1.50	.....	1.25	.....
New Braunfels, Texas	.50@ .60	1.00@1.20	1.00@1.20	.80@1.00	.75@ .90	.75@ .90
Olive Hill, Ky.	.50@1.00‡	1.00	1.00	1.00	1.00	1.00
Rocky Point, Va.	.50@1.00	1.40@1.60	1.30@1.40	1.15@1.35	1.10@1.20	1.00@1.05
WESTERN:						
Atkinson, Kans.	.25	2.00	2.00	2.00	2.00	1.60‖@1.90
Blue Springs & Wymore, Neb.	.25	1.45	1.45	1.35c	1.25d	1.20
Cape Girardeau, Mo.	1.25	.....	1.25	1.25	1.00	.....
Kansas City, Mo.	1.00	1.80	1.80	1.80	1.80	1.80
Kirkfield, Ontario	.70	1.05	.90	.90	.90	.90
Rock Hill, St. Louis county, Mo.	1.35	1.35	1.35	1.35	1.35	1.35

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Branford, Conn.	.60	1.70	1.45	1.20	1.05	.....
Duluth, Minn.	.90	2.25	1.90	1.50	1.35	1.35
Dwight, Calif.	1.00	1.00	1.00	.90	.90	.....
Eastern Maryland	1.00	1.60	1.60	1.50	1.35	1.35
Eastern Massachusetts	.85	1.75	1.75	1.25	1.25	1.25
Eastern New York	.75	1.25	1.25	1.25	1.25	1.25
Eastern Pennsylvania	1.10	1.70	1.60	1.50	1.35	1.35
Knippa, Texas	2.50	2.00	1.55	1.45	1.25	1.25
New Haven, New Britain, Meriden & Wallingford, Conn.	.60	1.70	1.45	1.20	1.05	1.05
Northern New Jersey	1.60	2.00	1.80	1.40	1.40	.....
Oakland and El Cerritto, Cal.	1.00	1.00	1.00	.90	.90	.....
Sheboygan, Wis.	1.00	1.10	1.10	1.10	1.10	.....
Springfield, N. J.	1.70	2.10	2.10	1.80	1.80	.....
Westfield, Mass.	.60	1.50	1.35	1.20	1.10	1.10

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Berlin, Utley, Montello and Red Granite, Wis.—Granite	1.80	1.70	1.50	1.40	1.40	.....
Coldwater, N. Y.—Dolomite			1.50 all sizes			
Columbia, S. C.—Granite	.....	.....	1.75	.....	1.50	.....
Eastern Penn.—Quartzite	1.20	1.35	1.25	1.20	1.20	1.20
Havelock, Ontario	.....	2.60	2.10	2.10	.....	.....
Lithonia, Ga.	.75	1.75	1.60	1.40	1.35	1.25
Lohrville, Wis.—Granite	1.65	1.70	1.65	1.45	1.50	.....
Middlebrook, Mo.—Granite	3.00@3.50	.....	2.00@2.25	2.00@2.25	.....	1.25@2.00
Northern New Jersey (Basalt)	1.50	2.00	1.80	1.40	1.40	.....
Richmond, Calif.—Quartzite	.75	.....	1.00	1.00	1.00	.....
Somerset, Pa. (sand-rock)	1.85@2.00a	.....	1.35@1.50	.....	1.00@1.50	.....
Toccoa, Ga. (granite)	1.50	.....	.....	1.25	1.25	1.25

*Cubic yd. †1 in. and less. ‡Two grades. ‖Rip rap per ton. (a) Sand. (b) to ¼ in. (c) 1 in., 1.40. (d) 2 in., 1.30. (e) Dust. (f) ¼ in. (h) less 10c discount. (i) 1 in., 1.40.

Agricultural Limestone
(Pulverized)

Alton, Ill.—Analysis 99% $CaCO_3$, 0.3% $MgCo_3$; 90% thru 100 mesh	6.00
Asheville, N. C.—Analysis, 57% $CaCO_3$, 39% $MgCO_3$; 50% thru 100 mesh; 200-lb. burlap bag, 4.00; bulk	2.75
Belfast and Rockland, Me. (rail), Lincolnville, Me. (water), analysis $CaCO_3$ 90.04%; $MgCO_3$ 1.5%, 100% thru 14 mesh, bags	4.50
Bulk	3.00
Branchton and Osborne, Penn.—100% thru 20 mesh; 60% thru 100 mesh; 45% thru 200 mesh. (Less 50 cents commission to dealers)	5.00
Cape Girardeau, Mo.—Analysis, 93% $CaCO_3$, 3.5% $MgCO_3$; pulverized; 50% thru 50 mesh	1.50
Cartersville, Ga.—Analysis 68% $CaCO_3$, 32% $MgCO_3$; pulverized	2.50
50% thru 50 mesh	2.00
Chaumont, N. Y.—Pulverized limestone, bags, 4.00; bulk	2.50
Chico, Tex.—⅛ in. down	1.50
200 mesh	10.00
Colton, Calif.—Analysis 90% $CaCO_3$, bulk	4.00
Cypress, Ill.—90% thru 100 mesh	1.35
Danbury, Conn., Rockdale and West Stockbridge, Mass.—Analysis, 90% $CaCO_3$, 5% $MgCO_3$; 50% thru 100 mesh; paper bags, 4.75; cloth, 5.25; bulk	3.25
Henderson, N. C. (paving dust)—80% thru 200 mesh, bags	4.25@ 4.75
Bulk	3.00@ 3.50
Analysis $CaCO_3$, 56%; $MgCO_3$, 42%; 65% thru 200 mesh, bags	3.95
Bulk	2.70
Hillsville, Penn.—Analysis, 94% $CaCO_3$, 1.40% $MgCO_3$; 75% thru 100 mesh; sacked	5.00
Jamesville, N. Y.—Analysis, 89.25% $CaCO_3$; 5.25% $MgCO_3$; pulverized, bags, 4.00; bulk	2.50
Knoxville, Tenn.—Analysis, 52% $CaCO_3$, 37% $MgCO_3$; 80% thru 100 mesh; bags, 3.95; bulk	2.70
80% thru 200 mesh, bulk	3.50
Marblehead, Ohio—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$; 60% thru 100 mesh; 70% thru 50 mesh; 100% thru 10 mesh; 80 lb. paper sacks, 5.00; bulk	3.50
Marion, Va.—Analysis, 90% $CaCO_3$, pulverized, per ton	2.00
Mayville, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 90% thru 100 mesh	3.90@ 4.50
Milltown, Ind.—Analysis, 94.50% $CaCO_3$, 33% thru 50 mesh, 40% thru 50 mesh; bulk	1.35@ 1.60
Olive Hill, Ky.—50% thru 50 mesh, 2.00; 90% thru 4 mesh	1.00
Piqua, Ohio—Total neutralizing power 95.3%; 99% thru 10, 60% thru 50; 50% thru 100	2.50@ 2.75
100% thru 10, 90% thru 50, 80% thru 100; bags, 5.10; bulk	3.60
99% thru 100, 85% thru 200; bags, 7.00; bulk	5.50
Rocky Point, Va.—Analysis 99.5% $CaCO_3$, 0.25% $MgCO_3$; 50% thru 200 mesh; bags, 3.25@3.50; bulk	2.00@ 2.25
Waukesha, Wis.—90% thru 100 mesh, 4.50; 50% thru 100 mesh	2.10
Watertown, N. Y.—Analysis, 96-99% $CaCO_3$; 50% thru 100 mesh; bags, 4.00; bulk	2.50

Agricultural Limestone
(Crushed)

Alton, Ill.—Analysis 99% $CaCO_3$, 0.3% $MgCO_3$; 50% thru 4 mesh	3.00
Atlas, Ky.—Analysis over 90% $CaCO_3$; 90% thru 4 mesh	1.00@ 2.00
Bedford, Ind.—Analysis, 98.5% $CaCO_3$, 0.5% $MgCO_3$; 90% thru 10 mesh	1.50
Bettendorf, Iowa—97% $CaCO_3$, 2% $MgCO_3$; 50% thru 100 mesh; 50% thru 4 mesh	1.50
Blackwater, Mo.—Analysis, 99% $CaCO_3$; 90% thru 4 mesh	.75
Bridgeport and Chico, Texas—Analysis, 94% $CaCO_3$, 2% $MgCO_3$; 100% thru 10 mesh	1.75
50% thru 4 mesh	1.50
Chasco, Ill.—50% thru 100 mesh	1.20
Chico, Texas—50% thru 50 mesh; bulk	1.50

(Continued on next page)

Agricultural Limestone

Chicago, Ill.—50% thru 100 mesh; 90% thru 4 mesh	.80
Columbia, Krause, Valmeyer, Ill.—Analysis, 90% $CaCO_3$; 90% thru 4 mesh	1.35
Cypress, Ill.—90% thru 50 mesh, 50% thru 100 mesh, 90% thru 50 mesh, 90% thru 4 mesh, 50% thru 4 mesh	1.35
Ft. Springs, W. Va.—Analysis, 90% $CaCO_3$; 90% thru 50 mesh	1.50
Garnet, Okla.—All sizes	1.25
Gary, Ill.—Analysis, approx. 60% $CaCO_3$, 40% $MgCO_3$; 90% thru 4 mesh	.90
Kansas City, Mo.—50% thru 100 mesh	1.25
Lannon, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 99% through 10 mesh; 46% through 60 mesh	2.00
Screenings (¼ in. to dust)	1.00
Marblehead, Ohio.—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$, 32% thru 100 mesh; 51% thru 50 mesh; 83% thru 10 mesh; 100% thru 4 mesh (meal) bulk	1.60
Mayville, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 50% thru 50 mesh	1.85@ 2.35
Middlepoint, Bellevue, Kenton, Ohio; Monroe, Mich.; Huntington and Bluffton, Ind.—Analysis, 42% $CaCO_3$, 54% $MgCO_3$; meal, 25 to 45% thru 100 mesh	1.60
Milltown, Ind.—Analysis $CaCO_3$, 93.10%, 40% thru 50 mesh	1.35@ 1.60
Moline, Ill., and Bettendorf, Iowa—Analysis, 97% $CaCO_3$, 2% $MgCO_3$; 50% thru 100 mesh; 50% thru 4 mesh	1.50
Pixley, Mo.—Analysis, 96% $CaCO_3$; 50% thru 50 mesh	1.25
50% thru 100 mesh; 90% thru 50 mesh; 50% thru 50 mesh; 90% thru 4 mesh; 50% thru 4 mesh	1.65
River Rouge, Mich.—Analysis, 54% $CaCO_3$, 40% $MgCO_3$; bulk	.80@ 1.40
Stone City, Iowa.—Analysis, 98% $CaCO_3$; 50% thru 50 mesh	.75
Tulsa, Okla.—Analysis $CaCO_3$, 86.15%, 1.25% $MgCO_3$, all sizes	1.25
Waukesha, Wis.—90% thru 4 mesh	1.65

Pulverized Limestone for Coal Operators

Hillsville, Penn., sacks, 4.50; bulk	3.00
Piqua, Ohio, sacks, 4.50@5.00 bulk	3.00@ 3.50
Rocky Point, Va.—80% thru 200 mesh; bags	4.25@ 4.75
Waukesha, Wis.—90% thru 100 mesh, bulk	4.50

Glass Sand

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

Berkeley Springs, W. Va.—Glass sand	2.25
Cedarville and S. Vineland, N. J.—Damp	1.75
Dry	2.25
Cheshire, Mass.: 6.00 to 7.00 per ton; bbl	2.50
Columbus, Ohio	1.25@ 1.50
Estill Springs and Sewanee, Tenn.	1.50
Franklin, Penn.	2.25
Gray Summit and Klondike, Mo.	2.00
Los Angeles, Calif.—Washed	5.00
Mapleton Depot, Penn.	2.00@ 2.25
Massillon, Ohio	3.00
Mineral Ridge and Ohlton, Ohio	2.50
Oceanside, Calif.	3.00
Ottawa, Ill. (Contracts)	1.00
Pittsburgh, Penn.—Dry	4.00
Damp	3.00
Red Wing, Minn.: Bank run	1.50
Ridgway, Penn.	2.00@ 2.25
Rockwood, Mich.	2.75@ 3.25
Round Top, Md.	2.25
San Francisco, Calif.	4.00@ 5.00
St. Louis, Mo.	2.00
Sewanee, Tenn.	1.50
Thayers, Penn.	2.50
Utica, Ill.	1.00@ 1.15
Zanesville, Ohio	2.50

Miscellaneous Sands

City or shipping point	Roofing sand	Traction
Beach City, Ohio	1.75	1.50
Columbus, Ohio		.30@ .90
Eau Claire, Wis.	4.25	.65@ 1.00
Estill Springs and Sewanee, Tenn.	1.35@ 1.50	1.35@ 1.50

(Continued on next page)

Wholesale Prices of Sand and Gravel

Prices given are per ton, F.O.B., producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
EASTERN:						
Ambridge & So. H'g'ts, Penn.	1.25	1.25	1.15	.85	.85	.85
Attica and Franklinville, N. Y.	.75	.75	.85	.75	.75	.75
Buffalo, N. Y.	1.10	.95			.85	
Erie, Pa.		1.00*		1.50*	1.75*	
Farmingdale, N. J.	.58	.48	1.05	1.20	1.10	
Hartford, Conn.	.65*					
Leeds Junction, Me.		.50	1.75		1.35	1.25
Machias Jct., N. Y.		.75	.75		.75	.75
Montoursville, Pa.	1.35	1.00	.90	.85	.75	.75
Northern New Jersey	.50	.50	1.25	1.25	1.25	
Olean, N. Y.		.75	.75	.75	.75	.75
Shining Point, Penn.			1.00	1.00	1.00	1.00
Somerset, Pa.		1.85@2.00		1.35@1.50		
South Heights, Penn.	1.25	1.25	.85	.85	.85	.85
Washington, D. C.	.85	.85	1.70	1.50	1.30	1.30
CENTRAL:						
Algonquin and Beloit, Wis.	.50	.40	.60	.60	.60	.60
Attica, Ind.	.75	.75	.75	.75	.75	.75
Barton, Wis.		.50		.75		.75
Boston, Mass.‡	1.50	1.50	2.50		2.50	2.50
Chicago, Ill.	.70	.50	.50	.60	.60	.60
Columbus, Ohio		.70	.70	70	.70	
Des Moines, Iowa	.40	.40	1.50	1.50	1.50	1.50
Eau Claire, Wis.	.65	.50	1.00			.95
Elgin, Ill.		.20*	.50*	1.50*	1.50*	1.50*
Elkhart Lake, Wis.	.60	.60	.60	.75	.50	.50
Ferrysburg, Mich.		.50@ .80	.60@1.00	.60@1.00		.50@1.25
Ft. Dodge, Iowa	.85	.85	2.05	2.05	2.05	2.05
Ft. Worth, Texas	2.00	2.00	2.00	2.00	2.00	2.00
Grand Haven, Mich.		.40@ .80		.60@1.00		
Grand Rapids, Mich.	.50	.50	.90	.80	.80	.70
Hamilton, Ohio		1.00			1.00	
Hersey, Mich.		.50		.70	.70	.60
Humboldt, Iowa		.85	2.00	2.00	2.00	
Indianapolis, Ind.	.60	.60		.90	.75@1.00	.75@1.00
Mason City, Iowa	.45@ .55	.45@ .55	1.35@1.45	1.45@1.55	1.40@1.50	1.35@1.45
Mankato, Minn.		.50	1.35	.60e	1.35	1.35
Mattoon, Ill.	.75	.75	.75	.75	.75	.75
Milwaukee, Wis.		1.01	1.21	1.21	1.21	1.21
Moline, Ill.	.60@ .85	.60@ .85	1.00@1.20	1.00@1.20	1.00@1.20	1.00@1.20
Northern New Jersey	.70	.70			1.60	
Oregon City, Ore.		1.25	1.25	1.25	1.25	1.25
Palestine, Ill.	.75	.75	.75	.75	.75	.75
Silverwood, Ind.	.75	.75	.75	.75	.75	.75
St. Louis, Mo.	1.18	1.45	1.65	1.45	1.65	1.45c
Terre Haute, Ind.	.75	.60	.85	.85	.75	.75
Wolcottville, Ind.	.75	.75	.75	.75	.75	.75
Waukesha, Wis.		.45	.60	.60	.65	.65
Winona, Minn.	.40	.40	1.50	1.25	1.10	1.00
Yorkville, Sheridan, Oregon, Moronts, Ill.		.40@ .70	.30@ .50	.50@ .60	.60	.60
Zanesville, Ohio	.70	.60	.50		.80	
SOUTHERN:						
Charleston, W. Va.		All sand, 1.40.		All gravel, 1.50.		
Chattanooga, Tenn.		1.45			1.20	1.20
Knoxville, Tenn.	1.00	1.00	1.20	1.20	1.20	1.00
Lindsay, Texas					.55	
Macon, Ga.	.50	.50		1.00	1.00	1.00
New Martinsville, W. Va.	1.00	.90@1.00	1.20			.80@ .90
Roseland, La.	.25	.20	1.50	.85	.75	.75
WESTERN:						
Kansas City, Mo.	.80	.70				
Los Angeles, Calif. (points all around) (d)	.60	.50	.85	.85	.85	.85
Los Angeles district (bunkers)†	1.50	1.40	1.85	1.85	1.85	1.85
Phoenix, Ariz.	1.25*	1.00*	2.50*	2.00*@2.25*	1.75*	1.50*
Pueblo, Colo.	1.10*	.90*		1.80*		1.60*
San Diego, Calif.	.65@ .75	.65@ .75	1.50@1.60	1.20@1.40		1.00@1.20
Seattle, Wash. (bunkers)	1.50*	1.50*	1.50*	1.50*	1.50*	1.50*

Bank Run Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
Algonquin and Beloit, Wis.			Dust to 3 in., .40			
Boonville, N. Y.	.60@ .80		.55@ .75			1.00
Chicago, Ill.	.95					
Des Moines, Iowa	.50					
Dudley, Ky. (crushed silica)	1.10	1.10		.90		
East Hartford, Conn.			Sand, .75*			
Elkhart Lake, Wis.	.50					
Ferrysburg, Mich.						.65@1.00
Gainesville, Texas		.95				.55
Grand Rapids, Mich.	.50	.50		.60		
Hamilton, Ohio					.70	
Hersey, Mich.				.50		
Indianapolis, Ind.			Mixed gravel for concrete work, at .65			
Lindsay, Texas	1.30					.55
Macon, Ga.	.40					
Mankato, Minn.			Pit run sand, .50			
Moline, Ill. (b)	.60	.60	Concrete gravel, 50% G., 50% S., 1.00			
Ottawa, Oregon, Moronto and Yorkville, Ill.			Ave. .60 per ton all sizes			
Roseland, La.	.60					
St. Louis, Mo.			Mine run gravel, 1.55 per ton			
Shining Point, Penn.			Concrete sand, 1.10 ton			
Smithville, Texas	.50	.50	.50	.50	.50	.50
Summit Grove, Ind.	.50	.50	.50	.50	.50	.50
Waukesha, Wis.	.60	.60	.60	.60	.60	.60
Winona, Minn.	.60	.60	.60	.60	.60	.60
York, Penn.	1.10	1.00				

(a) ¾ in. down. (b) River run. (c) 2½ in. and less.
*Cubic yd. †Include freight and bunkerage charges and truck haul. ‡Delivered on job.
(d) Less 10c per ton if paid E.O.M. 10 days. (e) pit run.

Core and Foundry Sands

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

City or shipping point	Molding, fine	Molding, coarse	Molding, brass	Core	Furnace lining	Sand blast	Stone sawing
Aetna, Ill.				.30@ .35			
Albany, N. Y.	2.75	2.75	2.75	1.00@2.75		1.25@4.00	
Arenzville, Ill.	1.50@1.75			1.00			
Beach City, Ohio	1.75@2.25	1.75@2.25		1.50@2.00	2.00@2.50		1.75
Columbus, Ohio	2.00@2.50	1.50@2.50	2.00@3.00	.20@ .30	2.50	3.50@4.50	1.50@2.00
Eau Claire, Wis.				1.00		3.00	
Elco, Ill.	Ground silica per ton in carloads—18.00@31.00						
Elnora, N. Y.			1.75				
Estill Springs and Sewanee, Tenn.	1.25			1.25		1.35@1.50	
Franklin, Penn.	2.00	2.00	2.00	2.00			
Gray Summit and Klondike, Mo.	1.75	1.75	2.00	2.00	1.00		.85@1.00
Joliet, Ill.	No. 2 molding sand; loam for luting and open hearth work—.65@.85						
Kasota, Minn.							1.00
Mapleton Depot, Penn.	2.00	2.00				2.00	
Massillon, Ohio	2.50			2.00	2.00		
Michigan City, Ind.				.15@ .30			
Mineral Ridge and Ohlton, Ohio	2.00*	1.75		2.00*	1.75	1.75*	
Montoursville, P'n.				1.25@1.40			
New Lexington, O.	2.50	2.25					
Ottawa, Ill.				1.25	1.25	4.00	3.00
Red Wing, Minn.	1.25		1.25	1.50	1.50	3.50	1.50
Ridgeway, Penn.	1.50	1.50		2.00			
Round Top, Md.			1.60			2.25	
San Francisco, Calif.	3.50	4.75	3.50	3.50@5.00	3.50@4.50	3.50@5.00	
Tamalco, Ill.		1.50@1.75					
Tamms, Ill.	Ground silica per ton in carloads—20.00@31.00						
Thayers, Penn.	1.25	1.25		2.00			
Utica, Ill.	.75	.80		.80	.80		
Utica, Penn.	1.75	1.75		2.00			
Warwick, Ohio	1.75*@2.25	1.75*		1.75*@2.25			
Zanesville, Ohio	2.75@3.00	1.75@2.25	2.75				

*Damp. †Crude silica, not washed or dried.

Crushed Slag

City or shipping point	Roofing	¼ in. down	½ in. and less	¾ in. and less	1½ in and less	2½ in. and less	3 in. and larger
EASTERN:							
Buffalo, N. Y., Emporium and Dubois, Pa.	2.25	1.25	1.25	1.25	1.25	1.25	1.25
Eastern Penn. and Northern N. J.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Reading, Pa.	2.50	1.00		1.25			
Western Penn.	2.50	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Ironton, Ohio		1.45		1.45		1.45	
Jackson, Ohio		1.05		1.30	1.05		1.30
Toledo, Ohio	1.50	1.25	1.25	1.25	1.25	1.25	1.25
Youngst'n, O., dist.	2.00	1.25	1.35	1.35	1.25	1.25	1.25
SOUTHERN:							
Ashland, Ky.		1.55		1.55	1.55	1.55	
Ensley and Alabama City, Ala.	2.05	.80	1.35	1.25	.90	.90	.80
Longdale, Roanoke, Ruessens, Va.	2.50	1.00	1.25	1.25	1.25	1.15	1.15
Woodward, Ala.		.80	.90@1.25	.90@1.25	.90@1.05	.90	.90

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Blk.	Ground burnt lime, Bags	Lump lime, Blk.	Lump lime, Bbl.
EASTERN:								
Berkeley, R. I.			12.00					2.20
Buffalo, N. Y.				12.00				
Chazy, N. Y.	12.50	9.50	9.00	13.50	11.50	16.50	10.50	2.90
Lime Ridge, Penn.							5.00a	
West Stockbridge, Mass.	12.00	10.00	5.60					2.00t
Williamsport, Penn.			10.00				6.00	
York, Pa.		9.50	10.50	10.50			8.00	1.65i
CENTRAL:								
Afton, Mich.							8.50	1.46
Carey, Ohio	12.50	8.50@9.50	9.50		9.50		9.00	
Cold Springs, Ohio (f)	12.50	10.00	9.00		9.00	11.00	9.00	
Delaware, Ohio	12.50	10.00	9.00	10.00			9.00	1.50
Frederick, Md.		10.00	9.50	10.00			7.50	1.45
Gibsonburg, Ohio (f)	12.50				9.00			
Huntington, Ind.		8.50	8.50		9.00	11.00	8.00	1.50c
Luckey, Ohio (f)	12.50							
Marblehead, Ohio		8.50	8.50				8.00	1.50c
Marion, Ohio		8.50	8.50				8.00	1.50c
Milltown, Ind.		9.00@10.00		10.00p			8.00₃	1.40n
Sheboygan, Wis.							9.50	
Tiffin, Ohio					9.00			
White Rock, Ohio	12.50				9.00	11.00		
Wisconsin points (f)		11.50					9.50	
Woodville, Ohio	12.50	8.50	8.50	13.50	9.00	11.00₁	8.00	1.50₂
SOUTHERN:								
Allgood, Ala.	12.50	10.00			8.50		8.50	1.50
El Paso, Tex.							14.00	1.75
Graystone, Landmark and Wilmay, Ala.	12.50	10.00					8.50	1.50
Keystone, Ala.	12.00	10.00	10.00	10.00	9.00		8.50	1.50u
Knoxville, Tenn.	20.25	10.00@11.00	10.00	10.00			8.50	1.50
Ocala, Fla.	13.00		13.00			1.60	12.00	1.70
WESTERN:								
Calcite, Colo.							9.00‖	
Kirtland, N. M.							15.00	
New Braunfels, Texas	12.00	12.00	10.00	12.00			9.50	1.50
San Francisco, Calif.	21.00	21.00	12.50@15.00	21.00			14.50	1.90v
Tehachapi, Calif.			8.00				13.00z	2.20x
Seattle, Wash.	19.00	19.00	12.00	19.00	19.00		18.60	2.30

†50-lb. paper bags; (a) run of kilns; (c) wooden, steel 1.70; (d) wood; (e) per 180-lb. barrel; (f) dealers' prices; (g) to 9.50; (h) to 1.75; (i) 180-lb. net barrel 1.65; 280-lb. net barrel, 2.65 (m) finishing lime, 3.00 common; (n) common lime; (o) high calcium; (p) to 11.00; (q) to 8.50; (r) to 1.50; (s) in 80-lb. burlap sacks; (t) to 3.00; (u) two 90-lb. bags; (v) oil burnt; wood burnt 2.25@2.50; (x) wood, steel 2.30; (z) to 15.00; (*) quoted f.o.b. New York; (‡) paper bags; (w) to 1.50 in two 90-lb. bags, wood bbl. 1.60; (¶) to 10.00; (₁) 80-lb. paper bags; (₂) 180 lb. net, 187 lb. net, 1.70. (₃) to 9.00.

Miscellaneous Sands

(Continued)

City or shipping point	Roofing sand	Traction
Gray Summit and Klondike, Mo.	2.00	1.75
Mapleton, Depot, Penn.		2.00
Massillon, Ohio		2.25
Mineral Ridge and Ohlton, Ohio	*1.75@ 2.00	*1.75
Montoursville, Penn.		1.35
Ottawa, Ill.	1.25@ 1.50	
Red Wing, Minn.		1.25
Round Top, Md.	2.25	1.75
San Francisco, Calif.	3.50@ 4.50	3.50@ 4.50
Thayers, Penn.		2.25
Warwick, Ohio		2.25

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point.

Baltimore, Md.:	
Crude talc (mine run)	3.00@ 4.00
Ground talc (20-50 mesh), bags	10.00
Cubes	55.00
Blanks (per lb.)	.08
Pencils and steel worker's crayons, per gross	.08 1.25
Chatsworth, Ga.:	
Crude talc	5.00@ 6.00
Ground (20-50 mesh), bulk	7.50@10.00
Ground (150-200 mesh), bulk	8.00@16.00
Pencils and steel worker's crayons, per gross	1.50
Chester, Vt.:	
Ground talc (150-200 mesh), bulk	9.00@10.00
Including bags	10.00@11.00
Chicago and Joliet, Ill.:	
Ground (150-200 mesh), bags	30.00
Dalton, Ga.:	
Crude talc	5.00
Ground talc (150-200) bags	10.00
Pencils and steel workers' crayons, per gross	1.00@ 2.50
Emeryville, N. Y.:	
(Double air floated) including bags;	
325 mesh	14.75
200 mesh	13.75
Hailesboro, N. Y.:	
Ground white talc (double and triple air floated) including bags, 350 mesh	15.50@20.00
Henry, Va.:	
Crude (mine run)	3.50@ 4.50
Ground talc (150-200 mesh), bags	9.75@15.00
Joliet, Ill.:	
Ground talc (150-200) bags	12.00@30.00
Keeler, Calif.:	
Ground (200-300 mesh), bags	20.00@30.00
Natural Bridge, N. Y.:	
Ground talc (300-325 mesh), bags	13.00

Rock Phosphate

Prices given are per ton (2240-lb.) f.o.b. producing plant or nearest shipping point.

Lump Rock

Gordonsburg, Tenn.—B.P.L. 68-72%	4.50@ 5.00
Tennessee—F. O. B. mines, gross ton, unground Tenn. brown rock, 72% min. B.P.L.	5.00
Twomey, Tenn.—B.P.L. 65%, 2000 lb.	7.00@ 8.00

Ground Rock

(2000 lbs.)

Centerville, Tenn.—B.P.L. 65%	7.00
Gordonsburg, Tenn.—B.P.L. 65-70%	4.00@ 4.50
Mt. Pleasant, Tenn.—B.P.L. 65%; bulk	7.00
Twomey, Tenn.—B.P.L. 65%	7.25@ 8.25

Florida Phosphate

(Raw Land Pebble)

(Per Ton.)

Florida—F. O. B. mines, gross ton,	
68/66% B.P.L., Basis 68%	3.00
70% min. B.P.L., Basis 70%	3.55
72% min. B.P.L., Basis 72%	4.10
75/74% B.P.L., Basis 75%	4.85
77/76% B.P.L., Basis 77%	5.60

Fluorspar

Fluorspar, 85% and over calcium fluoride, not over 5% silica, per net ton, f.o.b. Illinois and Kentucky mines	16.00
No. 2 lump, per net ton	19.00
Fluorspar, foreign, 85% calcium fluoride, not over 5% silica, c.i.f. Philadelphia, duty paid, per net ton	16.00
Fluorspar, No. 1 ground bulk, 95 to 98% calcium fluoride, not over 2½% silica, per net ton, f.o.b. Illinois and Kentucky mines	32.50

Special Aggregates

Prices are per ton f.o.b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco-chips
Barton, Wis., f.o.b. cars		10.50
Brandon, Vt.—English pink and English cream	*11.00	*11.00
Buckingham, Que.—Buff stucco dash		‡12.00@14.00
Chicago, Ill. — Stucco chips, in sacks f.o.b. quarries		17.50
Crown Point, N. Y.—Mica Spar		8.00@10.00
Easton, Pa. — Green grits or facings		*8.00
Haddam, Conn. — Felstone buff	15.00	15.00
Harrisonburg, Va.—Blk marble (crushed, in bags)	†12.50	†12.50
Ingomar, Ohio — Concrete facings and stucco dash		6.00@18.00
Middlebrook, Mo.—Red		20.00@25.00
Middlebury and Brandon, Vt.—Middlebury white‡	7.00@11.00	7.00@11.00
Milwaukee, Wis.		14.00@34.00
Newark, N. J.—Roofing granules		7.50
New York, N. Y.—Red and yellow Verona		32.00
Red Granite, Wis.		7.50
Sioux Falls, S. D.	7.50	7.50
Stockton, Calif. — "Natrock" roofing grits		10.00@20.00
Tuckahoe, N. Y.		10.00
Villa Grove, Colo.		13.00
Wauwatosa, Wis.		16.00@45.00
Wellsville, Colo.—Colorado Travertine Stone	15.00	15.00

‡C.L.
*C.L. including bags; L.C.L. 14.50.
‡C.L. including bags.

Potash Feldspar

Auburn and Brunswick, Me.—Color, white; 98% thru 140 mesh bulk 19.00

Bath, Me.—Color, white; analysis, potash, 12%; 100% thru 180 mesh, bags, 21.00; bulk 18.00

Buckingham, Que.—Color, white; analysis, K_2O, 12-13%; Na_2O, 1.75%; bulk 9.00

De Kalb Jct., N. Y.—Color, white; bulk (crude) 8.00

East Hartford, Conn.—Color, white (60-80 mesh); bags 17.00@20.00
Finer grades 20.00@30.00

Erwin, Tenn.—Color, white; analysis, 12.07% K_2O, 19.34% Al_2O_3; Na_2O, 2.92%; SiO_2, 64.76%; Fe_2O_3, .36%; 98.50% thru 200 mesh, bags, 16.90; bulk 15.50

Los Angeles, Calif.—Color, white; analysis, K_2O, 10.35%; Na_2O, 3.62%; Al_2O_3, 18.71%; SiO_2, 65.48%; Fe_2O_3, .17%; 100% thru 150 mesh, bags, 24.00; bulk 22.00

Murphsboro, Ill.—Color, prime white; analysis K_2O, 12%; Na_2O, 2%; 65% SiO_2; crude, bags, 7.00; bulk 6.50
Pulverized; 98% thru 200 mesh, bags, 22.00; bulk 21.00
99% thru 100 mesh, bags, 21.00; bulk 20.00
100% thru 100 mesh; bags, 20.00; bulk 19.00

Penland, N. C.—Color, white; crude, bulk 8.00
Ground, bulk 16.50

Tenn. Mills—Color, white; analysis K_2O, 18%; Na_2O_3, 10%; 68% SiO_2; 99% thru 200 mesh; bulk 18.00
99% thru 140 mesh, bulk 16.00

Toronto, Can.—Color, flesh; analysis K_2O, 12.75%; Na_2O, 1.96%; crude.. 7.75
98% thru 180 mesh, bags, 21.00; bulk 20.00

Trenton, N. J.—Crude, bulk 12.00@27.00
99% thru 140 mesh; bulk 16.00
(Bags 11 cents each, non-returnable)

Wheeling, W. Va.—Color, white; analysis,, K_2O, 9.50%; Al_2O_3, 16.70%; Na_2O, 3.50%; SiO_2, 69.50%; 99% thru 140 mesh, bulk 19.00

Glen Tay, Ontario, Can.—Color, flesh red to pink; analysis, K_2O, 12.81%; Fe_2O_3, .11%, etc., crude, bulk 6.50@ 7.50

Blended Feldspar
(Pulverized)

Tenn. Mills—Bulk 16.00@20.00

Toughkenamon, Pa.—Color, white to light cream; 98% thru 125-150 mesh, bags, 12.00@13.00; bulk 10.00

Chicken Grits

Belfast and Rockland, Me.—(Limestone), bulk, per ton 11.00

Los Angeles Harbor (limestone), 100-lb. sack, 1.00; sacks, per ton, 8.50@9.50†; bulk, per ton 6.00@7.00†

Toughkenamon, Pa.—(Feldspar) 100-lb. bags, 1.00; bulk, per ton 10.00

Danbury, Conn., Rockdale and West Stockbridge, Mass. — (Limestone) bulk 7.50@9.00*

Gypsum, Ohio.—(Gypsum) per ton 10.00

Seattle, Wash.—(Limestone), bulk, per ton 12.50

*L.C.L.
†Less than 5-ton lots.

Sand-Lime Brick

Prices given per 1000 brick f.o.b. plant or nearest shipping point, unless otherwise noted.

Barton, Wis.	10.50
Boston, Mass	14.50
Brighton, N. Y.	*19.75
Dayton, Ohio	12.50@13.50
Detroit, Mich.	*17.50
Farmington, Conn.	16.00
Flint, Mich.	12.50@16.00
Grand Rapids, Mich.	12.00
Hartford, Conn.	*19.00
Jackson, Mich.	13.00
Lancaster, N. Y.	13.00
Madison, Wis.	12.00
Michigan City, Ind.	12.00
Milwaukee, Wis.	*13.00
Minneapolis and St. Paul, Minn.	10.00
New Brighton, Minn.	10.00
Pontiac, Mich.	13.00
Portage, Wis.	15.00
Rochester, N. Y. (del. on job)	19.75
Saginaw, Mich.	13.00
San Antonio, Texas	13.00@13.50
Sebewaing, Mich.	12.00
Syracuse, N. Y.	14.00@15.00
Terra Cotta, D. C.	13.50
Toronto, Canada	12.00
Wilkinson, Fla.-White	12.00
Buff	16.00

*Delivered on job. †Delivered in city limits.
‡Less 5%.

Portland Cement

Prices per bag and per bbl, without bags net in carload lots.

	Per Bag	Per Bbl.
Albuquerque, N. M.		3.47
Atlanta, Ga.		2.35
Baltimore, Md.		2.35
Birmingham, Ala.		2.30
Boston, Mass.		2.63
Buffalo, N. Y.		2.38
Butte, Mont.	.90¼	3.61
Cedar Rapids, Iowa		2.34
Charleston, S. C.		2.35
Cheyenne, Wyo.	.82¾	3.31
Cincinnati, Ohio		2.37
Cleveland, Ohio		2.29
Chicago, Ill.		2.10
Columbus, Ohio		2.34
Dallas, Texas	.48¾	2.15
Davenport, Iowa		2.29
Dayton, Ohio		2.38
Denver, Colo.	.66¼	2.65
Detroit, Mich.		2.05
Duluth, Minn.		2.09
Houston, Texas		2.60
Indianapolis, Ind.		2.29
Jackson, Miss.		2.60
Jacksonville, Fla.		2.50
Jersey City, N. J.		2.33
Kansas City, Mo.		2.02
Los Angeles, Calif.	.60	2.40
Louisville, Ky.		2.27
Memphis, Tenn.		2.60
Milwaukee, Wis.		2.15
Minneapolis, Minn.		2.32
Montreal, Que.		1.90
New Orleans, La.		2.40
New York, N. Y.		2.25
Norfolk, Va.		2.17
Oklahoma City, Okla.		2.56
Omaha, Neb.		2.51
Peoria, Ill.		2.27
Philadelphia, Penn.		2.41
Phoenix, Ariz.		3.70
Pittsburgh, Penn.		2.09
Portland, Colo.	.72½	2.90
Portland, Ore.		2.90
Reno, Nevada	.75¼	3.01
Richmond, Va.		2.47
Salt Lake City, Utah	.70¼	2.81
San Francisco, Calif.		2.31
Savannah, Ga.		2.50
St. Louis, Mo.	.55	2.20
St. Paul, Minn.		2.32
Seattle, Wash.	10c discount	2.65
Tampa, Fla.		2.60
Toledo, Ohio		2.20
Topeka, Kans.		2.40
Tulsa, Okla.		2.43
Wheeling, W. Va.		2.17
Winston-Salem, N. C.		2.79

NOTE—Add 40c per bbl. for bags.

Mill prices f.o.b. in carload lots, without bags, to contractors.

	Per Bag	Per Bbl.
Buffington, Ind.		1.85
Chattanooga, Tenn.		2.45*
Concrete, Wash.		2.35
Davenport, Calif.		2.05
Detroit, Mich.		2.15
Hannibal, Mo.		2.05
Hudson, N. Y.		2.05
Leeds, Ala.		1.95
Mildred, Kans.		2.35
Nazareth, Penn.		1.95
Northampton, Penn.		1.95
Steelton, Minn.		1.90
Toledo, Ohio		2.20
Universal, Penn.		1.85

*Including sacks at 10c each.

Gypsum Products—CARLOAD PRICES PER TON AND PER M SQUARE FEET, F. O. B. MILL

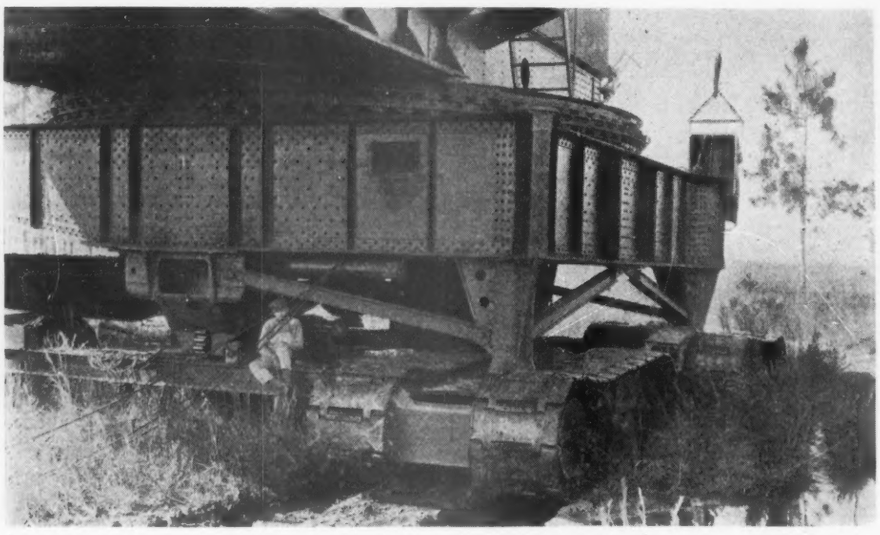
	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco Calcined Gypsum	Cement and Gauging Plaster	Wood Fiber	White Gauging	Sanded Plaster	Keene's Cement	Trowel Finish	—Plaster Board— ¼x32x 36". Wt. 1500 lb. Per M Sq. Ft.	—Plaster Board— ½x32x 36". Wt. 1850 lb. Per M Sq. Ft.	Wallboard, ⅜x32 or 48". Lgths. 6'-10', 1850 lb. Per M Sq. Ft.
Centerville, Iowa	3.00	3.50	15.00	8.00	9.00	9.50	9.50		25.80	10.00			
Detroit, Mich.‡				11.30	11.30	11.30		8.00					
Delawanna, N. J.								‡9.00			.14s	.15s	40.00
Douglas, Ariz.			7.00			15.50d	18.50		30.00	15.50			
Grand Rapids, Mich.	2.75	6.00	6.00	8.00	9.00	9.00	17.50		24.55	20.00			
Gypsum, Ohio‡	3.00	4.00	6.00	8.00	9.00	9.00	18.00	7.00	27.00	18.00		15.00	30.00
Hanover, Mont.				11.80									
Los Angeles, Calif.				10.30k									
Port Clinton, Ohio	3.00	4.00	6.00	10.00	9.00	9.00	21.00	7.00	30.15	20.00		20.00	30.00
Portland, Colo.				10.00									
San Francisco, Calif.			12.00	13.40r	14.40r		15.40r						
Seattle, Wash.	6.70		11.00	10.00									
Sigurd, Utah									18.00a				
Winnipeg, Man.	5.00	5.00	7.00	13.00							20.00		33.00

NOTE—Returnable bags, 10c each; paper bags, 1.00 per ton extra (not returnable).
*to 3.00; †to 11.00; ‖to 12.00; ‡prices per net ton, sacks extra; (a) to 25.00; (b) net; (c) gross.
(d) hair fibre; (f) delivered; (h) delivered in 6 states; (i) delivered on job; (k) sacks 12c extra, rebated.
(m) includes paper bags; (o) includes jute sacks; (r) including sacks at 15c; (s) per board; (t) to 16.50.

New Machinery and Equipment

Caterpillar Mounting for a 500-Ton Dragline

STEAM-SHOVEL design has undergone very marked improvement during the last few years. To appreciate this, one has only to compare the design of a few years ago with the present-day machines.



An 8-yd. dragline excavator weighing approximately a million pounds and mounted on self-propelling caterpillars

It is only 14 years ago that the Bucyrus Co. shipped the first dragline to be mounted on caterpillars. It was a machine driven by an oil-engine and weighing approximately 96 tons. At that time it was seriously questioned whether this type of mounting would ever prove practical for excavating machinery. Today most all the smaller shovels are equipped with this mounting.

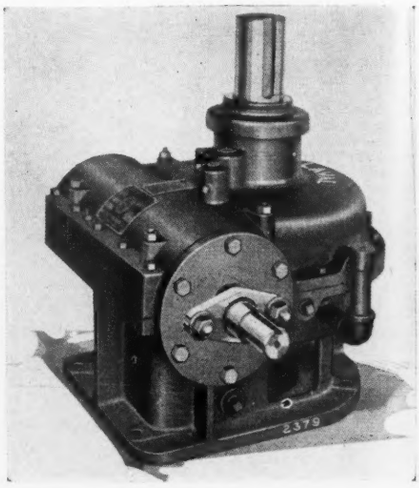
There has now been built and placed in operation in the field, caterpillar mounting for the Class 320 dragline. This mounting, also available for the 320-B shovel, is composed of four units, one under each corner of the base. These units are made up of two caterpillar belts 36 in. wide, each of which forms a continuous track for two large diameter rollers, an idler tumbler and a driving tumbler.

The caterpillars are almost shoulder high to an average man. Some idea of the size of this new caterpillar-mounted machine is given by the fact that, ready for operation, it weighs approximately a million pounds, or 500 tons. In spite of this tremendous weight, the bearing area of the caterpillar belts is such that it can propel itself across soft, yielding ground without difficulty.

The mounting, of course, is of interest to the owner and user of such a large machine, in that it eliminates a large number of the pitmen and track men which are required when such a machine is mounted on railroad trucks. Another great advantage to the man in the field is that this mounting does away with track breakage which is bound to occur if care is not used by the pit men. This new machine also makes the turning of corners a simple matter compared with the troublesome job of turning a truck mounted machine.

New Worm Gear Speed Reducer

A BRIEF mention was made of the new types of speed reducers in our annual review number. Among those described and illustrated was the new De Laval worm reduction gear for vertical shaft drive.



New speed reducer with vertical shaft on the low speed side

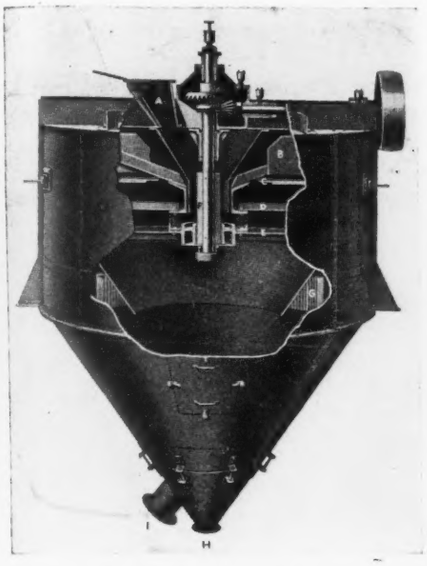
The vertical shaft drive is made with the driven shaft extending either up or down, and an oil pump in the casing cover keeps the upper shaft bearing supplied with oil and in high speed, high power units, supplies the wheel tooth and worm thread surfaces also. Circulation of oil to the lower wheel shaft bearing and to the thrust plate is assured by spiral oil grooves.

The De Laval worm reduction gears are made for ratios from 4 to 1 up to 100 to 1 in one step. By using two steps, that is, a reduction consisting of a high speed worm meshing with a worm wheel on the shaft of a low speed worm, and the latter meshing with the slow speed worm wheel, making three working parts all together, the De Laval Co. can supply gears for all ratios up to 8000 to 1.

The caterpillar mounted dragline moving through low-lying, wet ground

Centrifugal Air Separator

THE "Gayco" separator made by the Rupert M. Gay Co., New York, was described in our Dec. 26 issue under dust conveyors and collectors. Although the description of its operation was essentially correct it was put under the wrong classification. It



Air separator to be used on 80-mesh and finer separations

is in no sense of the term a dust collector but is entirely self contained and though in appearance similar to an air separator it does not function like one. It does the same work as a screen and acts as a separating device for fine materials ranging from 80 to 350 mesh. There are no outside blowers, fans or piping. Material to be separated is fed into the top of the machine and the fine and coarse material are discharged through the two spouts in the bottom.

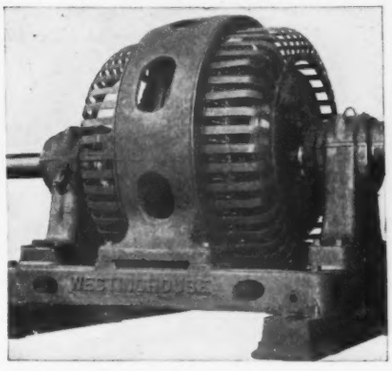
Magnetic Clutch Built Into Standard Synchronous Motor

A NEW type synchronous motor has been developed and is being offered for a motor having extra high starting torque, a low starting current, and the recognized high efficiency and unity power factor characteristics of a synchronous motor. The new motor, available in standard ratings from 60 to 600 h.p., with larger ratings as special machines, is being manufactured by the Westinghouse Electric and Manufacturing Co., and consists of a combination of two pieces of apparatus that have been well established in the electrical power field.

The apparatus consists of a standard synchronous motor combined with a magnetic clutch in a single compact unit. The over-all dimensions are practically the same as the hitherto standard synchronous motors of the same ratings, with the exception of the length, which is from 4 to 10 in. longer. It is said to combine in the one machine the high starting torque of the wound-rotor induction motor with the desirabilities of operation peculiar to the synchronous motor.

The clutch-type synchronous motor being offered by the Westinghouse Co. is started in the same manner and with the same equipment as used with a standard synchronous motor started under lightload conditions. It is said to be particularly adapted for driving, crushing or grinding machinery, rolling mills, and other loads requiring high starting torque. The starting torque of the clutch-type motor is the same as the maximum running torque, since the motor is brought to synchronous speed and fully excited before applying the load. It can thus exert any required torque up to the value of its pull-out torque during starting periods, without shock and at an acceleration rate controllable by adjusting the clutch excitation current through rheostat control. The clutch cannot be excited during starting periods, and as a result the rotor quickly reaches full speed.

The rotor section of the clutch is faced with asbestos lining, riveted to a steel ring and made in halves for easy removal. The armature member of the clutch has a smooth surface where it comes in contact with the brake lining, and steel shims may



New synchronous motor with built-in magnetic clutch

be inserted between the asbestos lining and the ring to compensate for lining wear.

Ample clearance between the clutch plates is provided by spring plate construction. The armature member is mounted on a steel disc which has sufficient flexibility to allow the clutch faces to make contact when the clutch coil is excited. When excitation is removed, the flexible member will spring back into its normal position which provides sufficient clearance between the friction surfaces to prevent contact.

The motor shown in the illustration, rated at 575 h.p. at 180-r.p.m. and with 100% power-factor, occupies but 2½ in. greater space than a standard motor of the same rating. When compared with a standard motor with separate magnetic clutch and outboard bearing, the new single-unit motor is 49 in. shorter in length. A corresponding reduction in floor space exists for other sizes of motors.

New Concrete Breaker

THE Denver Rock Drill Manufacturing Co. announces the addition of the Model 15 Waugh concrete breaker to its line of products.

This machine has been designed to meet the needs of municipalities, contractors, public utilities and various industries for a compressed air operated demolition tool for use on jobs where drilling and blasting are impractical.

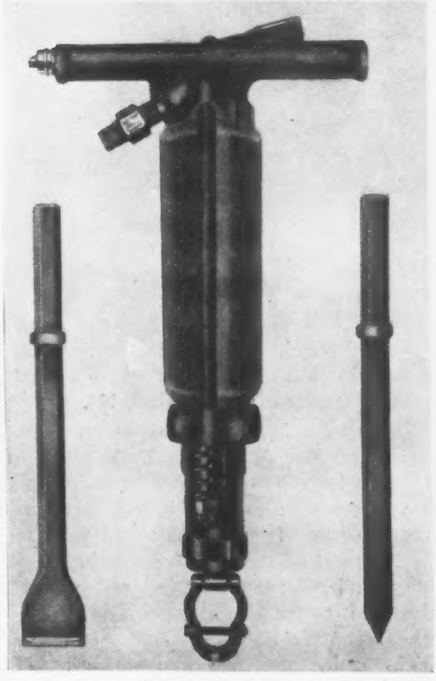
The use of the Model 15 is said to show substantial saving on time and labor in cutting and parting asphalt; breaking concrete sub-base in street repairs; breaking and excavating massive concrete; demolishing walls of brick, masonry or concrete; tearing up wood, brick or stone block pavements; fracturing boulders; loosening tightly packed or frozen soil or macadam; trenching in shale or hard pan.

In construction, the Model 15 Waugh concrete breaker is simple and rugged, and it is said to have great penetrative and fracturing power. Materials throughout are of the highest quality, and scientific heat treatments insure maximum service.

The valve and hammer are the only moving parts, and a simple tappet valve, actuated by a trigger conveniently placed on the handles, controls the operation of the machine. An unskilled man, without instruction, can operate the Model 15 instantly and effectively.

The length of the machine is 23½ in. When the chisel bit, gad or other special tool is inserted, the overall length is most convenient for a man of average height. Handles are of ample diameter and width.

The machine is said to be smooth in operation, a feature which minimizes fatigue.



Concrete breaker operated by compressed air

Lawrence Portland Makes Large Increase of Storage

THE Lawrence Portland Cement Co., Siegfried, Penn., has recently completed extensive additions to the storage capacity of their plant with the erection of a group of 24 concrete silos and a pack house which is equipped with four Bates Valve Bag Co. packing machines. A large bag storage house has also been added.

The 24 silos are arranged in two groups of 12, with a space of about 10 ft. between groups. By this construction, there is obtained five interstice bins in each unit of 12 silos. The silos are 28 ft. in diameter and 70 ft. 3 in. in height, with effective depth of 60 ft. The estimated capacity of each silo is 9500 bbl. and of the interstice bins about 1500 bbl. each, which gives a total storage capacity of about 240,000 bbl.

The cement is to be conveyed from the clinker grinding department of the plant to the silos by a Fuller-Kinyon pumping system. Screw conveyors will be used to transfer the cement from the bins to a point in the basement of the pack house, where another Fuller-Kinyon pumping system will transfer it to the bins over the Bates packers.

The entire structure was designed and built by the Burrell Engineering and Construction Co., Chicago, Ill.

New Cement Plant To Be Built in Buffalo (N. Y.) District

PLANS are being formulated by the Federal Portland Cement Co., a newly formed corporation fostered and controlled by the Buffalo Slag Co. of Buffalo, N. Y., for a $2,000,000 cement plant to be erected in the vicinity of Buffalo, according to a recent announcement.

The exact site of the proposed plant has not been decided upon, but it is understood that a waterfront location is preferable. The Buffalo Slag Co. owns property at the foot of Fifth street in Lackawanna, a desirable location, but it has no water front facilities.

It is said that there is a good supply of limestone and gypsum in the vicinity of the proposed plant. Slag can be readily obtained from the nearby steel plants, at the present time. It is necessary to haul cement into Buffalo, from a distance of 200 miles, and this will be eliminated by this new plant.

Another site under consideration is the slag company's plant at the foot of Katharine street on the Hamburg turnpike, also on the River road.

The new plant when completed will have a capacity of 3,000 bbl. per day of cement, it was said at the Buffalo Slag Co. offices and it will employ approximately 300 men.

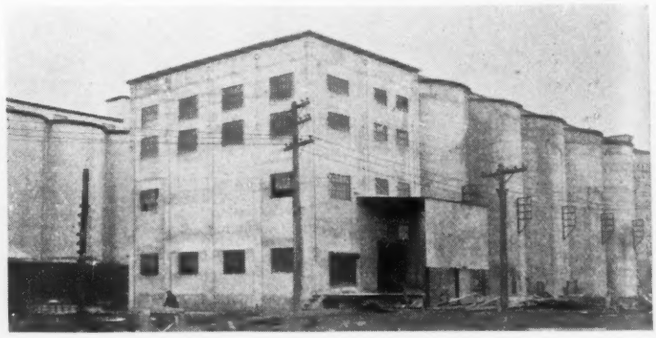
The company also plans to erect plants of the same type in Cleveland and Chicago, each to cost $2,000,000.—*Buffalo (N. Y.) Courier.*

(L. A. Beeghly, president of the Buffalo Slag Co., Buffalo, and the Standard Slag Co., Youngstown, Ohio, is the president of the Federal Portland Cement Co. The Bethlehem Steel Corp., operating nine of the 21 blast furances in Buffalo district, is reported to be interested in the project.)

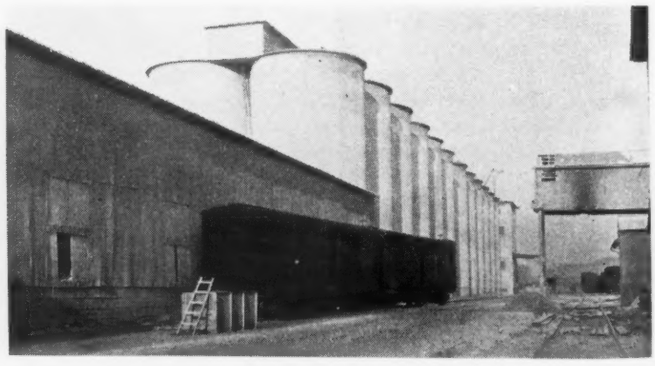
Large Damage Through Fire at Cement Plant

A RECENT fire of undetermined origin at the cement plant of the Cayuga Operating Co., Portland Point, N. Y., caused damage, which officials of the firm today estimated at about $200,000, before being brought under control.

The flames worked their way into the wooden framework of the stock house and damaged it somewhat, then got into a pile of bags waiting to be filled with cement. Here it smouldered along for quite a time before finally being extinguished. The water used to fight the fire came in contact with some of the machinery in the plant and also with abont 50,000 bbl. of cement waiting to be bagged. The latter was stated to have been badly affected and probably unfit for sale, thereby boosting the loss by many thousands of dollars.—*Ithaca (N. Y.) Journal-News.*



Left—North end and, right, west side of new concrete storage silos of Lawrence Portland Cement Co.



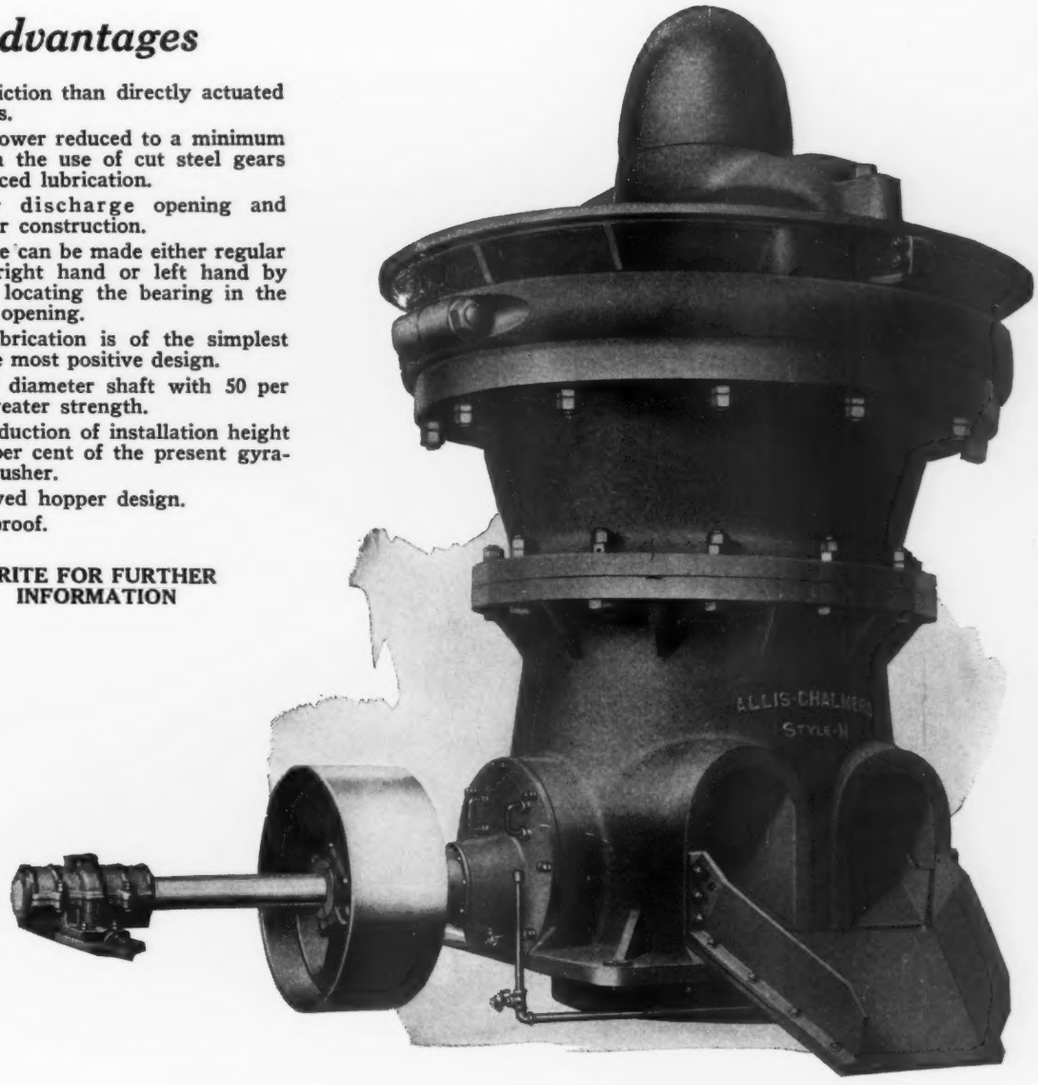
Left—North end of new pack house. Right—South end of new silos at Lawrence Portland Cement Co. plant at Siegfried, Pennsylvania

Allis-Chalmers Style "N" GYRATORY CRUSHER

Advantages

1—Less friction than directly actuated crushers.
2—Horsepower reduced to a minimum through the use of cut steel gears and forced lubrication.
3—Greater discharge opening and stronger construction.
4—Machine can be made either regular drive, right hand or left hand by simply locating the bearing in the proper opening.
5—The lubrication is of the simplest and the most positive design.
6—Larger diameter shaft with 50 per cent greater strength.
7—The reduction of installation height of 16 per cent of the present gyratory crusher.
8—Improved hopper design.
9—Dust proof.

WRITE FOR FURTHER INFORMATION



ALLIS-CHALMERS PRODUCTS
Electrical Machinery
Steam Turbines
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ALLIS-CHALMERS MANUFACTURING COMPANY

MILWAUKEE, WISCONSIN. U.S.A.

ALLIS-CHALMERS PRODUCTS
Flour and Saw Mill Machinery
Power Transmission Machinery
Pumping Engines-Centrifugal Pumps
Steam and Electric Hoists
Air Compressors - Air Brakes
Agricultural Machinery
Condensers

Universal Portland To Build 1,500,000 Barrel Plant at Cleveland

THE Universal Portland Cement Co., Chicago, Ill., has just bought a tract of land in Cleveland upon which it intends to build a modern cement plant with capacity of 1,500,000 bbl. annually.

The land is located on the Cuyanoga river in the heart of the industrial section. Limestone, one of the principal raw materials, will be transported from Rogers City, Mich., by boat and unloaded at the plant. Other material required for manufacturing will be procured locally. The plant will be located on the Newburgh & South Shore Railway which connects with all railroads entering Cleveland. Its central location in Cleveland will permit cement to be trucked direct from mill to the job. Being located on the Cuyahoga river, cement can be shipped by boat to lake ports such as Buffalo, Toledo and Detroit.

Plans for the new plant which have already been drawn are being perfected and it is expected construction will start in the near future.

The Universal company now has plants at Chicago, Pittsburgh, and Duluth, with annual capacity of over 16,500,000 bbl., which upon the completion of the new plant at Cleveland will be increased to about 18,000,000 bbl. capacity.

Federal Cement Company to Build Plant at Cleveland

ANNOUNCEMENT of the Federal Cement Co.'s intentions to build a $2,000,000 cement plant of 3000 bbl. per day capacity at Cleveland, Ohio, was made recently by L. A. Beeghly, president of the Standard Slag Co., Youngstown, Ohio, and the Buffalo Slag Co., Buffalo, N. Y., who is said to be the president of the Federal company also. Although the slag companies which Mr. Beeghly heads crush slag at many steel plants including those of the U. S. Steep Corp., he was emphatic in his denial that the steel companies were interested in the new project. The people interested in the corporation have not yet been named. This report follows close upon the recent announcement of the building of a 3000 bbl. per day plant in the Buffalo district by the same company.

Financing is assured, Mr. Beeghly said, and no stock will be offered to the public. Bonds may be floated in about four months, or after the Buffalo plant is well under way, he said.

The Buffalo plant will be built first, the Cleveland plant next. The company was incorporated a short time ago and its officers have not yet been elected.

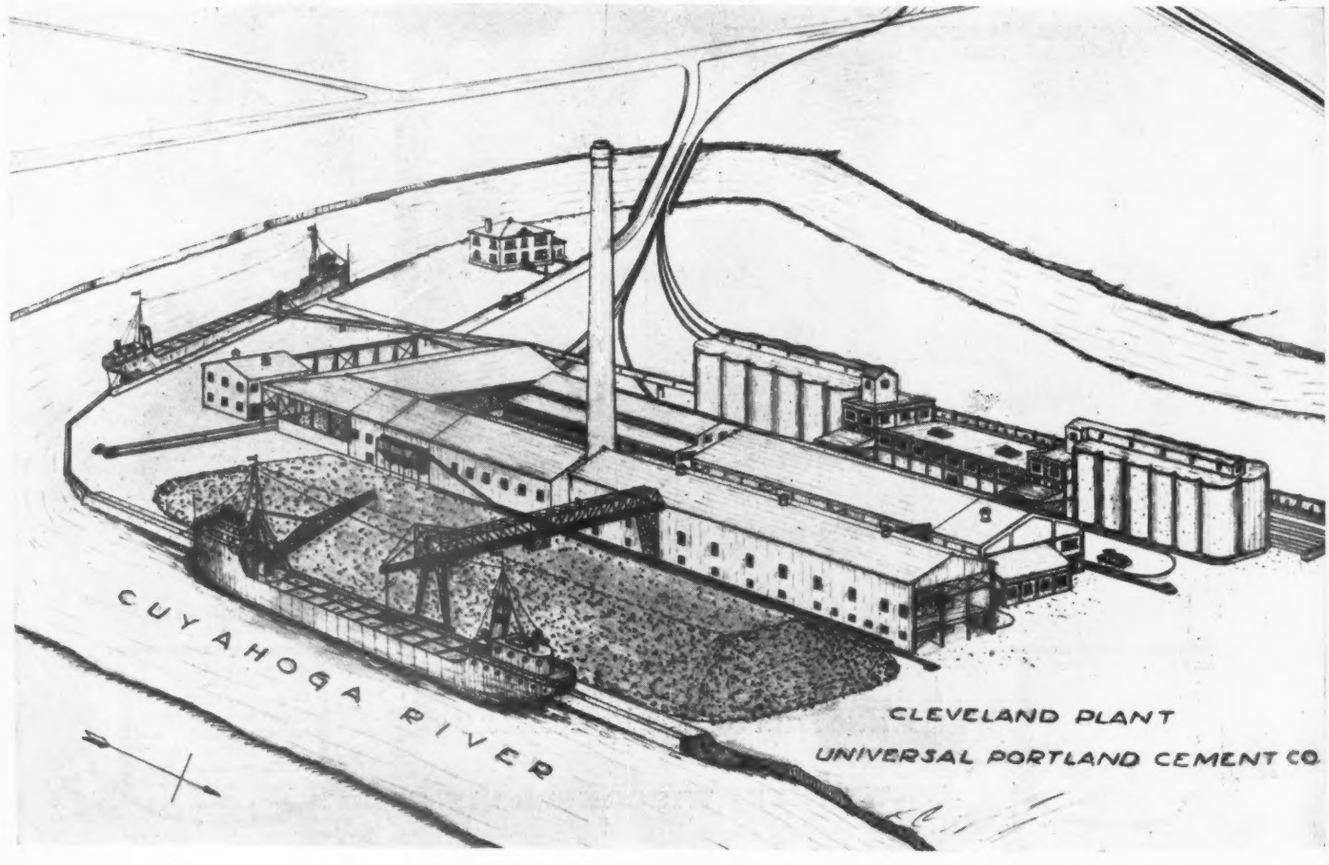
The site of the Cleveland plant has not been selected, Mr. Beeghly said, but he expects construction will start early in the summer. Its production will be distributed in this territory by rail, motor truck and possibly lake steamer to some extent.—*Cleveland (Ohio) Plain Dealer.*

Gilmore City Cement Plant to Open Soon

C. H. McNIDER, Mason City banker, purchaser of the Gilmore City Portland Cement Corp., Gilmore City, Iowa, at a price said to be $700,000, plans to recondition the cement plant and open it again within a short time, it was stated at a recent meeting of the corporation directors. The directors went into session to make final ratification of the sale of the plant to Mr. McNider.

The Gilmore City cement plant was sold to Mr. McNider last October, but final ratification of the contract and closing of the deal was put off until the meeting in order to allow time for inventory of materials on hand at the plant. The plant itself brought $600,000 and the materials $100,000. (See Rock Products, November 14 issue, p. 77.)

Mr. McNider was not present at the directors' meeting, but H. S. Van Alstine of Gilmore City, speaking for him, stated that Mr. McNider would spend several hundred thousand dollars to put the plant in working condition again. The capacity of the plant is also to be increased. H. Webster, superintendent of the mill, has been retained by Mr. McNider to have active charge under his supervision.—*Des Moines (Iowa) Register.*



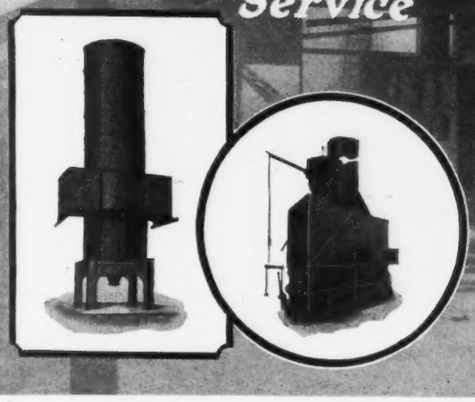
Architect's sketch of the new plant to be built at Cleveland, Ohio, by the Universal Portland Cement Co.

ARNOLD & WEIGEL

CONTRACTORS & ENGINEERS

WOODVILLE, OHIO, U.S.A.

"Arnold Kiln"
"Weber Hydrator"
Engineering
Service

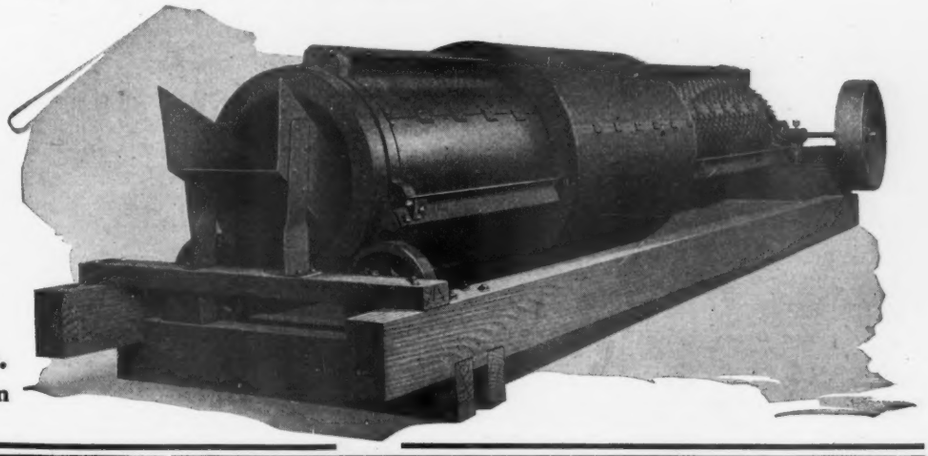


Toepfer

The quality that pays dividends in satisfaction

All Toepfer Products embody the quality which affords lasting satisfaction. The combination scrubber and screen, shown below, is a typical example. It is so sturdily constructed that maintenance is kept at the minimum; it affords a large production at a low cost. This scrubber and screen requires less water than others, but washes thoroughly, making a perfect separation, and turning out an extremely clean product.

Other Toepfer Products that are upholding the Toepfer reputation are: Sand Washers, Elevators, Washing Screens, Feeders, Grizzlies, Conveyors, Bin Gates, and Perforated Metals. Which are you interested in?



W. Toepfer & Sons Co.
Milwaukee **Wisconsin**

News of All the Industry

Incorporations

United Stone Products Co., Pittsburgh, Pa., $10,000.

Slagstone Products Corp., Wilmington, Del., $100,000.

Western Wallboard Co., Longview, Wash., increased capital to $183,000.

Mutual Stone Co., St. Genevieve, Mo. H. E. Hines, W. B. Arnold and others.

Bear Rock Co., Williamsburg, Ky., $10,000. R. L. Sparks, E. E. Richards and others.

Brooksville Washed Rock Co., Brooksville, Fla., $150,000. K. W. Meguire, J. W. Norton and others.

Western Concrete Co., Inc., Dallas, Texas, $3,000. Bert Christie, Earle Silven and George Brown.

Kent Sand & Gravel Co., Cleveland, Ohio, $500. E. T. Butler, Jr., M. M. Feldner and A. O. Dickey.

Dubuque Stone Products Co., Dubuque, Iowa, $100,000. D. G. Rose, J. C. Collier and P. M. Nauman.

Fischer Stone & Construction Co., Daytona Beach, Fla., $25,000. J. E. McElroy, E. Fischer and others.

Florida Concrete Building Tile Co., Miami, Fla., $55,000. I. M. Johnson, 137 N. W. 11th Street, and others.

Florida Duntile Manufacturing Co., Lake Worth, Fla., $300,000. B. R. Garrett, C. A. Jensen and others.

Pennsylvania Gypsum Co., Wilmington, Del., $2,000,000. T. L. Croteau, Wilmington. (Corp. Trust Co. of America.)

East Coast Stone, Tile & Supply Co., West Palm Beach, Fla., $100,000. S. C. Lawrence, A. R. Phillips and others.

Duntile Products Co., Inc., Baltimore, Md. To manufacture cement blocks. Nathan Abrahamson and others. Office at 712 Equitable Building.

Cincinnati Concrete Co., Wilmington, Del. $2,100,000. To manufacture building material from cinders, cement, etc.

Star Sand & Gravel Corp., Rochester, N. Y., $25,000. J. E. and M. Redman, C. M. Wallace. (Attys., MacFarlane and Harris, Rochester.)

Greyhound Mortar Service Co., Huntington Park, Calif., $100,000. By Alfred H. Mitchell, O. A. Sterner and M. E. Childers, all of Los Angeles.

Van Owen Sand and Gravel Co., Los Angeles, Calif., $50,000. C. J. Fingey, J. B. McKibben, T. J. McFadden, N. C. Christensen and D. J. Coyne.

Portland Cement Products Co., New York, N. Y., $3,500,000. H. C. Hand, M. A. Castaldi and R. J. Gorman, all of New York. (U. S. Corporation Co.)

Edmonds Art Stone Co., Wilmington, Del., $50,000. T. L. Croteau, Alfred Jervis and A. L. Miller. (Corp. Trust Co. of America.) To manufacture and sell cement blocks.

Blue Island Concrete Block and Material Co., Chicago, Ill., $2,500. H. W. Lacky, C. H. Hunter and S. W. Streeter. Correspondent: Paul T. Klenk, mayor, Blue Island, Ill.

Uniform Mixed Concrete Corp., Los Angeles, Calif., $300,000. Walter L. Stine, of Burbank; J. Russell Ellis, of Glendale; M. Cunningham, H. S. Austin, John D. Hill and others of Los Angeles.

Standard Soapstone Co., Arrington, Va. (Incorp. in N. Y.), $1,500,000 in preferred stock and 15,000 shares, no par, common. Principal office, Arrington, Va., and Michael J. Copps in charge.

Rodom Quarry Co., Rodom, Ill., $3,000. J. Paulcarter, A. G. Douglass and M. D. Smith. Correspondent: J. Paulcarter, Nashville, Ill. To mine, manufacture and market limestone and its products near Rodom, Ill.

Milan Sand & Gravel Co., Silvis, Ill., $20,000. R. S. Wise, Clarence Lickefett, C. N. Schadt, E. McCraney. Correspondent: Milan Sand & Gravel Co., 825 First Avenue, Silvis. To mine sand and gravel and crush stone, etc.

Timbuctoo Cement Products Co., Savanna, Ill., $10,000. Production of sand, gravel and cement blocks, products of brick, agricultural tile, etc. C. R. Dennison, John A. Lou, Spencer Otis. Correspondent: Herren, Johnson Bros., Burita & Herren, 160 N. La Salle Street, Chicago.

Sand and Gravel

Red Bank Sand and Gravel Co., Cincinnati, Ohio, is to erect a sand and gravel plant to include washing, screening and other equipment.

Ostrand and Hallet, Crosby, Minn., have opened a new gravel plant north of Fort Ripley, Minn. Material from the plant will be used on the new pavement to be constructed between Belle Prairie and Ft. Ripley, Minn.

Ohio Valley Sand and Gravel Co., Bellaire, Ohio, was recently put into the hands of a receiver by order of Judge W. A. Cowen. Charles Washman of Bellaire was appointed the receiver under bond of $50,000.

Quarries

Consumers Rock and Gravel Co., Los Angeles, Calif., are planning the erection of a new addition to their offices.

D. P. Davis Properties Co., St. Augustine, Fla., have purchased a coquina quarry on Anastasia Island, Fla., for a reported sum of $50,000. The deposit is said to contain about 150,000 cu. yd. of coquina gravel and rock which will be used in the company's development work on Davis Shores.

Lime

Southland Lime Co., Erin, Tenn., are now operating their recently purchased lime plants at Smithville, Tenn.

Oro Grande Lime Co., Douglas Building, Los Angeles, Calif., is making alterations to its warehouse to cost $2,000.

Gypsum

Standard Gypsum Co., Long Beach, Calif., is making alterations to its plant to cost about $1,000.

Columbia Plaster Wall Board Co. has engaged in business at 210 Thompson Street, Portland, Ore. The Pacific Building Materials Co. is owner.

Plastic Products Co., Milwaukee, Wis., of which R. W. Albrecht is president and treasurer, has let the contract for erection of a 76x200 ft. factory building to cost $25,000.

Cement

Nazareth Cement Corp., Nazareth, Pa., has completed plans and will soon begin the erection of a new three-story building at their plant at Nazareth, Penn., to be 50x70 ft., estimated to cost in excess of $60,000. It will be equipped largely for laboratory service. Ford, Bacon & Davis, Inc., New York, are the engineers.

Atlas Portland Cement Co. has settled in part some of the labor difficulties encountered due to a recent 10% reduction of labor wages at their Northampton, Penn., plant. According to the Allentown, Penn., "Call," many of the laborers at first dissatisfied over the cut in wages of 42½ cents per hour to 38 cents and who left their work because of this, have returned upon a promise that the situation would be adjusted.

Cement Products

International Cement Silo Co., Imlay City, Mich., plant was damaged by fire recently to the extent of from $5,000 to $10,000.

W. S. Cooper and Charles Bryden, Yuba City, Calif., are to establish a plant in Marysville, Calif., for the manufacture of cement building blocks.

Jax Cement Construction Co., Jacksonville, Fla., has been succeeded by P. G. Cannon and is planning the erection of a larger plant in a new location purchased for the purpose.

Art Stone Co., Sioux City, Iowa, at their annual stockholders' meeting elected the following officers and directors: A. S. Street, president; M. W. Richey, vice-president; E. A. Ives, treasurer; M. J. Henoch, secretary, and C. J. Ludwig, manager.

Diatomaceous Earth

Celite Products Co., Los Angeles, Calif., announce the removal of their Los Angeles office from the Van Nuys Building to 1320 South Hope Street.

Mica

Micolithic Co., Houston, Tex., which is about to build $1,000,000 plant on the ship channel, is also to install a $150,000 crushing plant on its mica field near Callado, Tex. The crushing plant will have a capacity of 500 tons per day, and the quarry plant a capacity of 1,000 tons. 5¾ miles of railway will also be laid.

Personal

Julius Norman, formerly connected with the Atlas Mortar Co., of San Francisco, Calif., is now connected with the Pacific Portland Cement Co.

Arthur D. Little, Inc., Cambridge, Mass., announce that Thorne L. Wheeler, formerly of Wheeler and Woodruff, chemical engineers of New York, has joined their organization. Dr. A. W. Francis and Dr. C. V. Holland have also been added to the large staff of chemical engineers in the organization. Dr. Francis and Dr. Holland have been engaged in special research work for the past few years.

Harry Donnelly, R. E. Donnelly and Hilan Donnelly, of the Ohio Gravel Ballast Co., Cincinnati, Ohio, have disposed of their interests in the Donnelly Realty Co. and have organized a general brokerage department in connection with the Donnelly Holding Co. Activities in the real estate and investment field will be continued and the same offices in the Ostend Building, Miami, Fla., occupied.

Obituary

Carter Miller, advertising manager of the Timken Roller Bearing Co., Canton, Ohio, died recently of pneumonia after a brief illness. Mr. Miller was a graduate of the public schools of Bay City, Mich., and of Kenyon College, Gambier, Ohio. He was connected with the Timken Co. in various capacities and was in charge of the advertising department of the company at the time of his death.

Manufacturers

John S. King Co., Inc., Cleveland, Ohio, are now located in their new offices on the 11th floor of Carnegie Hall, Huron Road, Cleveland.

Diamond Power Specialties Corp., Detroit, Mich., announces the appointment of M. J. Miller as sales engineer in charge of the Detroit district.

Harnischfeger Sales Corp., Milwaukee, Wis., announce the opening of a branch office at 608 Guaranty Building, Indianapolis, Ind., with J. H. Enochs in charge as district manager.

Mundy Sales Corp., New York, N. Y., has appointed the Carbine-Harang Machinery and Supply Co., New Orleans, La., distribution representative for the Louisiana territory and L. J. Breed, Chattanooga, Tenn., to act as distribution representative for Tennessee.

Timken Roller Bearings Co., Canton, Ohio, announces the appointment of R. C. Brower to the position of assistant to H. J. Porter, vice-president in charge of sales. Mr. Brower has been associated with the Timken Co. since 1916 and previous to his new appointment was assistant general manager of the sales and service department of the company.